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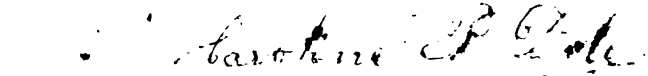

CARLETON'S COMPENDIUM

OF

PRACTICAL ARITHMETIC.

APPLIED TO THE

Federal and other Currencies.

Designed for the Use of Schools in the United States.

CONTAINING WHAT IS NECESSARY FOR THE
Merchant, the Mechanic, the Mariner, and the Farmer.

With a brief, but plain explanation of all the necessary RULES; and a sufficient number and variety of EXAMPLES in each to exercise the SCHOLAR.

Compiled at the request of the associated
INSTRUCTORS OF YOUTH IN BOSTON.

BY OSGOOD CARLETON, Esq.
Teacher of Mathematics.

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DISTRICT OF MASSACHUSETTS—TO WIT:

L. S. BE IT REMEMBERED, that on the seventeenth day of February, in the thirty fourth year of the Independence of the UNITED STATES OF AMERICA, OSGOOD CARLETON, of the said District, has deposited in this office, the title of a book, the right whereof he claims as author, in the words following, to wit:

CARLETON'S COMPENDIUM OF PRACTICAL ARITHMETIC, applied to the FEDERAL, and other currencies, designed for the use of schools, in the UNITED STATES, containing what is necessary for the Merchant, the Mechanic, the Mariner, and the Farmer; with a brief but plain explanation of all the necessary rules, and a sufficient number and variety of examples in each, to exercise the scholar: Compiled at the request of the Associated Instructors of Youth in Boston. By OSGOOD CARLETON, Esq. Teacher of Mathematics.

In conformity to the Act of the Congress of the United States, intitled "An Act for the Encouragement of Learning, by securing the Copies of Maps, Charts and Books, to the Authors and Proprietors of such Copies, during the times therein mentioned;" and also to an Act, intitled "An Act, supplementary to an Act intitled, An Act for the Encouragement of Learning, by securing the Copies of Maps, Charts and Books, to the Authors and Proprietors of such Copies, during the times therein mentioned; and extending the Benefits thereof to the Arts of Designing, Engraving and Etching Historical and other Prints."

WM. S. SHAW, *Clerk of the District of Massachusetts.*

Recommendation.

WE, the Subscribers, having examined, with considerable attention, "*Carleton's Compendium of Practical Arithmetic*," cheerfully recommend it as a work well calculated to facilitate the progress of young persons in the attainment of that useful and necessary art.

Masters,
- William Biglow.
- A. Bullard.
- Nathaniel Bridge.
- John Fessenden.
- John Haskell.
- Benjamin Holt.
- James B. Howe.
- Ezekiel Little.
- Lawson Lyon.
- Jonathan Snelling.
- R. Webb.

Ushers,
- Ephraim H. Farrar.
- Jonathan C. Hill.
- Nathaniel Storrs.
- W. Snelling.

Boston, April 17, 1810.

DEDICATORY PREFACE TO INSTRUCTORS OF YOUTH.

GENTLEMEN,

THE numerous Treatises on Arithmetic may induce many to suppose it unnecessary to add this to the number.

On examining the various systems now extant, none are found so well adapted to the use of schools in general, as might be wished: some being too voluminous, others too concise, some deficient in examples, others without plain directions necessary for young scholars.

The design of this manual is to accommodate schools in Town and Country with all that is necessary for the Merchant, the Mariner, the Mechanic, and the Farmer, on terms so moderate as to encourage its general use.

Demonstrations are omitted, because they would swell the book to little advantage to young pupils.

The arrangement differs from others; but Instructors will decide which rule shall succeed another, and whether all the rules, or every example in a rule, be taught, when a part appears sufficient.

The task of compiling this was very unexpectedly assigned to me, by the Associated Instructors of youth in Boston; how far I have acquitted myself, must be left to your candour to decide.

I will not contend that it is strictly free from errors, though I have aimed at correctness.

Any errors, deficiencies, or redundances, &c. communicated to the author, or the publisher, will be duly and thankfully received, and attended to, in any future edition, should one be deemed necessary.

That it may be as useful as intended, is the sincerest wish of, and will be the highest gratification to

THE AUTHOR.

Boston, April 17, 1810.

Contents.

		Page
Explanation of	Characters,	9
	Terms,	10
Notation or Numeration,		11
Simple	Addition,	12
	Subtraction,	15
	Multiplication,	17
	Division,	23
Addition	Of Federal Money,	28
	Compound,	30
Subtraction	Of Federal Money,	44
	Compound,	ib.
Decimal Fractions	Notation,	48
	Addition,	50
	Subtraction,	ib.
	Multiplication and Division,	ib.
	Reduction,	52
Reduction	Of Federal Money,	54
	Other Currencies, Weights and Measures,	56
Multiplication	Of Federal Money,	66
	Compound, including other Currencies, Weights and Measures, &c.	70
Division	Of Federal Money,	80
	Compound, including other Currencies, Weights, and Measures, &c.	84
Practice,		94
Single Rule of Three,	Direct,	104
	Inverse,	116
Rule of Proportion,		118
Interest	Simple,	124
	Compound,	139
Barter,		141
Loss and Gain,		144
Fellowship	Simple,	146
	Compound,	150

		Page
Tare and Tret,		152
Commission,		161
Insurance,		162
Brokerage,		164
Equation of Payments,		168
Discount	Common,	169
	Bank,	173
Exchange,		175
Alligation	Medial,	197
	Alternate,	198
Duodecimals	Notation,	200
	Addition,	ib.
	Subtraction,	ib.
	Multiplication,	201
	Applied to Mechanics' work,	202
	Applied to Cubic Measure,	203
Measuring	Grindstones,	205
	Ship's Tonage, &c.	206
Vulgar Fractions	Reduction,	208
	Addition,	218
	Subtraction,	219
	Multiplication and Division,	221
	Rule of Three,	224
Extraction of the	Square Root,	226
	Cube Root,	230
	Roots of all powers,	233
Miscellaneous Questions,		235
Forms of bills, notes, receipts, &c.		249

CHARACTERS USED IN THIS TREATISE.

= Equal to	The sign of equality, as 20*s.* = £. 1. i. e. twenty shillings are equal to one pound, &c.
+ Plus. or more.	The sign of Addition, and signifies that the numbers between which it is placed are to be added together, to discover their sum; thus, 5+3=8. i. e. 5 more, 3 are equal to 8; or if 5 and 3 are added together, their sum will be 8. When more than two numbers are placed in a line with this sign between them, it denotes that they are all to be added together; thus, 5+3+7+2=17; i. e. if 5, 3, 7, and 2, are added together, their sum will be equal to 17.
− Minus, or Less.	The sign of Subtraction, and signifies that the number following is to be subtracted from that which precedes it, to discover their difference or remainder, as 7—2=5; i. e. 7 less 2 is equal to 5: Or 7, having 2 subtracted from it, the remainder or difference is equal to 5.
× Into, With, Or By.	The sign of Multiplication, and signifies that the number preceding is to be multiplied by that which follows it, to discover their product; as 6×3=18; i. e. if 6 be multiplied by 3, their product will be 18.
÷ / 3)9(3 By	The signs of Division, as 9÷3=3, or $\frac{9}{3}$=3, also 3)9(3, either of these signifies that if 9 be divided by 3, the quotient will be equal to 3. Also 20÷4=5; $\frac{20}{4}$=5; or 4)20(5
∴ ∴ ∴ Proportion.	The sign of Proportion used in stating questions in the Rule of Three; also in other cases in which proportion is used: Thus, 5 ∴ 10 ∴ 8 ∴ 16; i. e. as 5 is to 10, so is 8 to 16.

√ Root. { The sign of the root of the number it precedes. Thus √ or $\sqrt{^2}$ is the sign of the square root, and denotes that the square root is to be extracted from the number it precedes; $\sqrt{^3}$ signifies the cubic root, and $\sqrt{^4}$ the biquadrate root, &c: thus, √ 1296=36, or thus, $\sqrt{^2}$ 1296=36.

EXPLANATION OF TERMS,

WHICH THE PUPIL OUGHT TO LEARN AND REMEMBER.

The number found by adding several together is called their *sum*. The number found by subtracting a less from a greater is called their *difference*, and sometimes the *remainder*.

In Multiplication, The number to be multiplied is called the *multiplicand*. The number by which it is to be multiplied is called the *multiplier*. The multiplicand and multiplier are in some cases called *factors*. The number found by the operation is called the *product* of the factors; in some cases it is called the *rectangle* of the factors.

In Division, The number given to be divided is called the *dividend*. The number by which it is to be divided is called the *divisor*. The number found by the operation is called the *quotient*. The number found by multiplying the divisor by a quotient figure, to set under the dividend and subtract from it, is called a *subtrahend*. The number set under the subtrahend (found by subtraction) is called a *remainder*.

Annex, is to place figures or ciphers at the right of others.

Prefix, is to place figures or ciphers at the left of others.

Integers are simple or whole numbers, as 26, 39, &c.

Fractions are broken numbers or parts of an integer, as $\frac{1}{4}$ is one fourth, $\frac{3}{8}$ is three eighths, &c.

Mixed numbers consists of integers and fractions, as $27\frac{3}{4}$ is twenty-seven and three fourths.

CARLETON'S COMPENDIUM

OF

PRACTICAL ARITHMETIC.

ARITHMETIC is the art of computing by numbers or figures, and has five principal RULES. viz. NOTATION, or NUMERATION, ADDITION, SUBTRACTION, MULTIPLICATION and DIVISION.

NOTATION OR NUMERATION

Teaches how to express the value of the ten figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, by their relative places, as in the following

NUMERATION TABLE.

Trillions	Hundreds of Thousands of Billions	Tens of Thousands of Billions	Thousands of Billions	Hundreds of Billions	Tens of Billions	Billions	Hundreds of Thous. of Millions	Tens of Thous. of Millions	Thousands of Millions	Hundreds of Millions	Tens of Millions	Millions	Hundreds of Thous.	Tens of Thousands	Thousands	Hundreds	Tens	Units
																		9
																	9	8
																9	8	7
															9	8	7	6
														9	8	7	6	5
													9	8	7	6	5	4
												9	8	7	6	5	4	3
											9	8	7	6	5	4	3	2
										9	8	7	6	5	4	3	2	1
									9	8	7	6	5	4	3	2	1	0
								9	8	7	6	5	4	3	2	1	0	1
							9	8	7	6	5	4	3	2	1	0	1	2
						9	8	7	6	5	4	3	2	1	0	1	2	3
					9	8	7	6	5	4	3	2	1	0	1	2	3	4
				9	8	7	6	5	4	3	2	1	0	1	2	3	4	5
			9	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6
		9	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7
	9	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8
9	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8	9

Note. The cipher (0) *when standing alone has no value; but when annexed to a significant figure or figures, it increases their value ten fold, thus* 0 *is of no value;* 26 *is twenty six,* 260 *is ten times twenty six, or two hundred and sixty.*

In the first line of the above Table, the figure 9 being in the unit's place, is called nine.

In the second line there are two figures 98, the 8 in the unit's place is called eight, the 9 being in the ten's place is ten times nine or ninety; therefore the two taken together are ninety eight, &c.

The last or lowermost line in the Table is to be read thus,

Nine trillions, eight hundred and seventy six thousand, five hundred and forty three billions, two hundred and ten thousand, one hundred and twenty three millions, four hundred and fifty six thousand, seven hundred and eighty nine.

EXAMPLES FOR PRACTICE.

Write down in figures, the following numbers, viz. Twenty seven; three hundred and forty six; seven thousand, five hundred and eighty two; ninety five thousand, two hundred and forty six; three hundred and forty six thousand, two hundred and twelve.

SIMPLE ADDITION

Teaches to collect numbers of the same denomination into one sum, which is called the sum of those numbers.

Rule. Place units under units, tens under tens, &c. and draw a line under the whole.

Begin with the lower figure of the units and add upwards; if the result be contained in one figure, set it down under its column, but if in more than one figure, set the right hand figure only under its column, and add what the other figure or figures will make to the next or ten's place, with which proceed as with the units; and thus proceed through all the columns, setting down the

whole under the left hand column. See the first example below.

To prove Addition, add all but the upper line together, then add this sum and the upper line together:

Or,

Begin at the top and add the whole downwards; the last sum will be equal to the first in either method, if the work be right.

EXAMPLES.

1	2	3	4
236	42368	493784	9364817
464	57815	167328	3721582
873	24637	526437	6485136
533	42184	385721	4213751
128	75362	649358	8495279
2234			
1998			
2234			

In the first example I begin with the lower figure in the unit's place, and add upwards, saying 8 and 3 are 11, and 3 are 14, and 4 are 18, and 6 are 24: I set the right hand figure 4 down under the 8, and carry the 2 to the ten's place, and add it, saying 2 that I carry, and 2 are 4, and 3 are 7, and 7 are 14, and 6 are 20, and 3 are 23; I set down the right hand figure 3 under the 2 in the ten's place, and add the left hand figure 2, with the next column or hundred's place, saying, 2 that I carry, and 1 are 3, and 5 are 8, and 8 are 16, and 4 are 20, and 2 are 22, which I set down, placing the right hand figure under the column, and the other at the left of it as above, and find the sum to be 2234.

In the same manner are all examples in Simple Addition to be added to find their sum.

To prove the work, I go over the addition again, leaving out the upper line, and find the sum to be 1998. Then I add this 1998 and the upper line together, and find the sum to be 2234, as before.

5	6	7
7136	213652	73928462
6372	847368	36471256
8756	374826	72513743
4285	637285	26487319
7426	283624	61725831
3627	152631	58641372
1243	625173	17389517
5714	362714	84736251
2573	716375	93827165

8	9	10
46300	3109	9
36	849637	36
517	9	637
9	756	9
3263	3	56
1	65	3689473
69	426394	4

Questions for Exercise.

1st. A man was born, A. D. 1741, in what year will he be 65 years of age? Ans. A. D. 1806.

2d. A man has paid $ 327 on a note of which $ 643 remain unpaid; how much was the note at first? Ans. $ 970.

3d. From A's house to B's is 46 miles, from B's to C's is 78 miles in the same direction; how far is it from A's house to C's? Ans. 124 miles.

4th. A merchant sold an invoice of goods, for which he received in money $ 792, and a note for the remainder, which was $ 2750; how much was the whole value? Ans. $3542.

5th. A man being asked his age, said he was 23 years old when his eldest son was born, who was then 25 yrs. old; what was the age of the father? Ans. 48 yrs.

6th. A tree was broken off by the wind, 16 feet from the ground, the top part broken off was 79 feet long; how high was the tree before it was broken? Ans. 95 feet.

7th. What number is that from which, if 750 be taken, 1268 will remain? Ans. 2018.

8th. A farm consists of 40 acres of plough land, 60 of pasture, 48 of mowing, 20 of orchard and garden, and 52 of wood land; how many acres in the whole? Ans. 220.

9th. A man at his death left an estate, which, after paying debts and charges to the amount of $ 2643, there remained to divide among seven children, $ 5648 each; how much was the whole estate? Ans. $ 42179.

SIMPLE SUBTRACTION

Teaches to take a less number from a greater, of the same denomination, to find their difference.

Rule. Place the less number under the greater, with units under units, tens under tens, &c.

Begin with the units, take the lower figure from the upper, and set down the remainder under them; but, if the lower figure be greater than the upper, take it from ten, and add the remainder to the upper figure, set down their sum, and carry (or add) one to the next lower figure, with which proceed in the same manner, and thus through the whole.

To prove Subtraction, add the remainder (or difference) to the less number, their sum will be equal to the greater number, if the work be right.

Examples.

	1	2	3
From	96371	78364	25936
Take	31758	37436	13251
Remainder.	64613		
Proof.	96371		

In the first example I begin with the unit figure of the lower line, saying, 8 from 1 I cannot take, therefore I must take it from 10, and 2 will remain, which 2 added to the upper figure 1 make 3, which three I set down under the 8, and carry 1 to the next lower figure 5, makes 6; which 6 taken out of the figure over it (7) there remains 1, which 1 I set down under the 5; then say, 7 from 3 I cannot take, but 7 from 10 there remains 3, which added to the upper figure 3, makes 6, to set down under the 7; then I carry 1 to the next figure 1, makes 2, which taken from 6, there remains 4, which I set down under the one; then say 3 from 9, there remains 6, which I set down under the 3, and find the whole difference (or remainder) to be 64613.

To prove the work, I add the difference found, and the less of the given numbers together; and find their sum equal to the greater given number.

4	5	6	7
53647	86497	64816	100000
27364	37938	39673	99999

Questions for Exercise.

1st. A man was 65 years old, A. D. 1806; in what year was he born? Ans. A. D. 1741.

2d. From A's house to B's is 46 miles, from A's to C's 124 miles, in the same direction; how far is it from B's house to C's? Ans. 78 miles.

3d. A man has paid $ 327 on a note of $ 970, how much remains unpaid? Ans. $ 643.

4th. A merchant sold an invoice of goods valued at $ 3548, received a part of the value in money, and a note for the balance, which was $ 789, how much money did he receive? Ans. $ 2759.

5th. A man being asked the age of his son replied, I was 23 years old when he was born, I am now 48; what was the son's age? Ans. 25 years.

6th. A tree 95 feet high was broken off by the wind, the top part which fell was 79 feet long; how high was the stump left? Ans. 16 feet.

7th. If $ 1564 be taken from $ 3620, how many will be left? Ans. $ 2056.

8th. From the vernal to the autumnal equinox is 186 days; how many days are there from the autumnal to the vernal equinox, allowing the year to be 365 days? Ans. 179 days.

9th. Said Jack to Tom, my purse and money together are worth twenty dollars, and the purse is worth 50 cents; how much money was in it? Ans. $ 19,50.

SIMPLE MULTIPLICATION

Teaches to find the amount of a simple number repeated a certain number of times.

Before the Pupil proceeds to multiply numbers, it is necessary for him to learn perfectly the following

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

To learn this table, begin with the upper line and left hand column you will find 1 ; and by following that line you will find twice 1 are 2, and three times 1 are 3, &c.

By taking the second line, and proceeding as before, you will find twice 2 are 4, three times 2 are 6, &c.

CASE I. When the multiplier does not exceed 12.

RULE. Place the multiplier under the multiplicand, with units under units, &c.

Begin with the unit figure, in the multiplicand, involve or multiply it, and also each figure in the multiplicand, into the multiplier, setting down the right hand figure of each product, and carrying what the others will make to the product of the next, as in Simple Addition.

Multiplication may be proved by casting out the nines from the multiplicand, setting the remainder at the right of a cross ; cast the nines out of the multiplier, setting the remainder at the left of the cross ; multiply these remainders together, and set the excess over nines, over the cross ; lastly, cast the nines out of the product, and set the remainder under the cross, which will be the same as that over it, if the work be right.

EXAMPLES.

Multiply	7 6 4 3 8 2	Multiplicand.	6
By	2	Multiplier.	2 × 3 Proof.
			6
	1 5 2 8 7 6 4	Product.	

In this first example, I say twice 2 are 4, which I set down directly under the multiplier ; then say twice 8 are 16, I set down the right hand figure 6, in the ten's place of the product, and carry the left hand figure 1, to the product of the next figure, saying twice 3 are 6, and 1 I carry makes 7, which I set down at the left of the 6 in the product ; then say twice 4 are 8, which I set down at the left of the 7 ; then say twice 6 are 12, I set down the 2 at the left of the 8 in the product, and carry the 1 to the product of the next figure, saying twice 7 are 14, and 1 I carry makes 15 ; this being the product of the left hand figure of the multiplicand, I set the whole down

at the left of the 2 in the product, and the work is done. I then prove it by casting out the nines, &c. as above directed.

Exam.	Multiplicands.	Multipliers.	Products.
2	769848	3	2309544
3	936949	4	3747796
4	4973607	5	24868035
5	73068	6	438408
6	385692	7	26998444
7	874624	8	69969992
8	48379 6	9	43541644
9	70369	10	703690
10	711611	11	7827721
11	187364	12	2248368

CASE II. When the multiplier exceeds 12.

RULE. Place the numbers as directed in Case I, then multiply by each figure in the multiplier separately as in that case, placing the first figure of each product under its multiplier; then add the several products into one sum, which will be the true product.

EXAMPLES.

1

764382 Multiplicand.
637 Multiplier.

5350674 — 3
2293146 — 7×3 Proof.
4586292 — 3

4869113 34 Product.

	Multiplicands.	Mult.	Products.
2	6348367	36	228541212
3	482639	639	308406321
4	57384	7369	422862696
5	73695	82739	6797450605
6	696374	463957	323087591918
7	1478395	5382716	7957780420820

CASE III. When there are ciphers between the significant figures of the multiplier, omit them, and multiply by the significant figures only, observing the directions in Case II, to place the first figure of each product under its multiplier.

EXAMPLES.

1 7 3 6 5 9 1 Multiplicand.
3 6 0 0 4 8 Multiplier.

5 8 9 2 7 2 8 3
2 9 4 6 3 6 4 3 × 4 Proof.
4 4 1 9 5 4 6 3
2 2 0 9 7 7 3

2 6 5 2 0 8 1 1 6 3 6 8 Product.

	Multiplicands.	Multipliers.	Products.
2	27846375	63400006	1765460342078250
3	5968	7069	42329172
4	7369	37004	272682476
5	74965	600967	44984022655
6	96384	730436	70402343424

CASE IV. When ciphers are annexed to either, or to both factors, neglect them, and proceed with the significant figures as before directed, and to the product annex as many ciphers as there are in both factors.

EXAMPLES.

1 4 3 6 1 0 0 0 Multiplicand.
5 6 0. Multiplier.

1
2 6 1 6 6 2 × 5 Proof.
2 1 8 0 5 1

2 4 4 2 1 6 0 0 0 0 Product.

	Multiplicands.	Mult.	Products.
2	736500	690000	508185000000
3	36947	10	369470
4	47369	100	4736900
5	85371	1000	85371000
6	436200	100	43620000
7	964800	3600	3473280000
8	470000	600	282000000

CASE V. When the multiplier (exceeding 12) can be found in the multiplication table, take the two numbers or figures which produce it, and multiply by one of those figures or numbers, and then multiply this product by the other, the second will be the true product.

EXAMPLES.

	1	
Multiply	5736 by 21.	Or thus, 5736
3 times 7, or, 7 times 3 are 21.	3	7
	17208	40152
	7	3
Product.	120456	120456

	Multiplicands.	Multipliers.	Products.
2	84369	48	4049712
3	96472	96	9261312
4	173648	132	22921536

SUPPLEMENT TO SIMPLE MULTIPLICATION.

CASE I. When the multiplier is a fraction, as $\frac{3}{4}$, $\frac{7}{8}$, &c. multiply by the numerator of the fraction, and divide the product by the denominator; the quotient will be the true product: If the numerator be 1, divide by the denominator only, as 1 will not multiply.

NOTE. A fraction is a part of an unit or whole number, and is expressed by two numbers placed one over another, thus, $\frac{3}{4}$ is read three fourths, $\frac{7}{8}$ is seven eighths, &c.

EXAMPLES.

	1	2
Multiply	57364 by $\frac{3}{4}$	4896 by $\frac{7}{8}$.
	57364	4896
	$\frac{3}{4}$	$\frac{7}{8}$
	4) 172092	8) 34272
Prod.	43023	4284

	Multiply	By	Product.
3	5 9 7 3	$\frac{5}{6}$	4 9 7 7 $\frac{3}{6}$
4	9 3 6 4 8	$\frac{7}{8}$	7 2 8 2 6 $\frac{3}{8}$

CASE II. When the multiplier is a mixed number, as, $5\frac{3}{4}$, $23\frac{5}{7}$, &c.

Multiply the multiplicand by the numerator of the fraction, divide the product by the denominator; then multiply the multiplicand by the whole number of the multiplier; add this product and the quotient together, their sum will be the true product.

EXAMPLES.

1 Multiply 59365 by $7\frac{3}{5}$.

5 9 3 6 5

$7\frac{3}{5}$

5) 1 7 8 0 9 5

3 5 6 1 9

4 1 5 5 5 5

Product. 4 5 1 1 7 4

	Multiply	By	Product.
2	96374	$21\frac{6}{7}$	2106460$\frac{5}{7}$
3	46930	$13\frac{3}{5}$	625733$\frac{1}{5}$

CASE III. When the multiplicand is a mixed number, multiply the multiplier by the numerator of the fraction; divide the product by the denominator; then proceed as in CASE II, with the whole numbers, &c.

EXAMPLES.

	Multiply	By	Product.
1	9638$\frac{3}{5}$	36	346989$\frac{3}{5}$
2	5963$\frac{7}{8}$	11	65602$\frac{5}{8}$

SIMPLE DIVISION

Teaches to find how often one number is contained in another of the same denomination.

The number to be divided is called the dividend.

That by which it is to be divided is called the divisor.

The number found by the operation is called the quotient.

The remainder, if there be any, will be less than the divisor.

When the divisor does not exceed 12, it is called Short Division.

In Short Division, this is the Rule;

Set the divisor at the left of the dividend, with a separating line between them; draw a line under the dividend.

Inquire how often the divisor is contained in the first figure (or as many as necessary) of the dividend, set the resulting figure under the right hand figure divided, if more than one is divided.

If there be a remainder, conceive it prefixed to the next dividend figure, which divide as before, and so proceed till the whole is divided, setting each resulting figure to the right of the last.

When a remainder is conceived to be prefixed to the next dividend figure, and the divisor is not contained in this increased number, set 0 under it in the quotient and then conceive the next dividend figure to be annexed to the last increased number; if the divisor is not then contained, set another 0 under it, and conceive the next dividend annexed, and so on till the divisor is contained in the increased number, or the whole of the dividend figures annexed; if, when the last dividend figure is used, the divisor is not contained, set 0 under it, and then all the dividend figures used, increased by one or more prefixed, will be the true remainder.

To prove Division, multiply the quotient by the divisor; to the product add the remainder, if any, the result will be equal to the dividend, if the work be right.

Examples.

1

Divide 1528764 by 2.

Divisor.	Dividend.
2)	1 5 2 8 7 6 4
Quotient.	7 6 4 3 8 2
	2
Proof.	1 5 2 8 7 6 4

In this example I place the divisor at the left of the dividend with a separating line between them, and a line under the dividend. I then inquire how often 2 is contained in the two left hand figures of the dividend 15. I find it contained 7 times and 1 remaining; I set the 7 down under the 5, and conceive the remainder 1, as prefixed to the next dividend figure 2, which will make 12; I now inquire how often 2 is contained in 12, which is 6 times; I set down the 6 at the right of the last quotient figure 7, and so proceed.

2

Divide 97364 by 12.

Divisor.	Dividend.
1 2)	9 7 3 6 4
Quot.	8 1 1 3+8 Re-
	12 mainder.
Proof.	9 7 3 6 4

3

Divide 10006 by 11.

Divisor.	Dividend.
1 1)	1 0 0 0 6
Quot.	9 0 9+7 Re-
	11 mainder.
Proof.	1 0 0 0 6

In the third example I found 11 contained 9 times in 100, and 1 remaining, which 1 prefixed to the next figure 0 made 10, in which 11 is not contained; I therefore set down 0 at the right of the last quotient figure 9, and conceive the next dividend figure 6 annexed to the 10, making 106, in which 11 is contained 9 times, and 7 remains.

	Divide	By	Quotient.
4	3747796	4	936949
5	24868035	5	4973607
6	438408	6	73068
7	6996992	8	874624
8	703690	10	70369

LONG DIVISION admits of several Cases, in all of which the divisor is to be placed at the left, and the quotient (when found) at the right of the dividend, with separating lines between them.

CASE I. When the figures of the divisor are all significant, or have no ciphers annexed.

Inquire how often the divisor is contained in as many of the left hand figures of the dividend as are necessary, and set the resulting figure at the right of the dividend, for the first figure of the quotient.

Multiply the divisor by this quotient figure, and place the product under that part of the dividend used, and subtract it therefrom.

To the remainder, annex the next figure of the dividend, and inquire how often the divisor is contained in this number; place the resulting figure in the quotient, at the right of the other, and so proceed till all the dividend figures are brought down.

When a dividend figure is annexed to a remainder, and the divisor is not contained in this increased number, set 0 in the quotient, and annex another, &c.

When the last dividend figure is annexed, if the divisor is not contained in that number, it will be the true remainder, and 0 must be set in the quotient.

EXAMPLES.

Divide 271138 by 26.

Divisor.	Dividend.	Quotient.	
26)	271138	(10428	In this example, after
	26	26	finding the first remainder
			1, and annexing the next
	111	62568	dividend figure 1 thereto, I
	104	20856	find 26 is not contained in
		10 Rem.	it, there being but 11, I set
	78		0 in the quotient, and annex
	52	271138 Proof.	the next dividend figure 3,
			which makes 113, &c.
	218		
	208		
	10	Remainder.	

	Divide	By	Quotient.
2	228541212	36	6348367
3	308406342	639	$482639\frac{21}{639}$
4	424412078	7396	$57384\frac{14}{7396}$
5	6097450605	82739	73695
6	323087591918	463957	1478395

CASE II. When ciphers are annexed to the divisor.

Separate them from the significant figures, and also an equal number of figures or ciphers from the right of the dividend; divide the remaining figures as usual, and to the remainder (if any) annex the figures separated from the dividend; if there be no remainder the figures separated from the dividend will be the true remainder. Hence it is evident that any number may be divided by 10, by separating one figure from the right of the dividend; and by 100, by separating two, &c.

EXAMPLES.

1 Divide 96437200 by 365000.

Divisor. Dividend. Quotient.

365|000)96437|200(264

730

2343

2190

1537

1460

Remainder. 77200

	Divide	By	Quotient.
2	247369	7300	$33\frac{6469}{7300}$
3	736432	93600	$7\frac{81232}{93600}$
4	3473280000	3600	964800
5	3641725	10	$364172\frac{5}{10}$
6	9735875	1000	$9735\frac{875}{1000}$

CASE III. When the divisor can be found in the multiplication table, take the two figures which produce it; divide by one of them, as in Short Division, then divide the quotient by the other, the second will be the true quotient.

If there be a remainder in one, or both operations, multiply the first divisor by the last remainder; to the product add the first remainder, the sum will be the true remainder.

EXAMPLES.

1 Divide 120456 by 21.

3 times 7 are 21.

3)120456
7) 40152
Quotient. 5736

Or thus,

7)120456
3)17208
Quotient. 5736

2 Divide 597364 by 35.

5 times 7 are 35.

5)597364
7)119472+4
Quotient. 17067+3

First Divisor, 5
Last remainder, 3
Product, 15
First remainder, add 4
True remainder, 19
Or $\frac{19}{35}$.

	Divide	By	Prod.
3	4049712	48	84369
4	9261312	96	96472
5	22921536	132	173648

SUPPLEMENT TO SIMPLE DIVISION.

CASE I. When the divisor is a fraction.

Multiply the dividend by the denominator of the fraction, and divide the product by the numerator.

NOTE. This Case, and Case I of the Supplement to Simple Multiplication, prove each other.

EXAMPLES.

1 Divide 43023 by $\frac{3}{4}$.

43023.
$\frac{3}{4}$
3)172092
57364 quotient.

2 Divide 4284 by $\frac{7}{8}$.

4284
$\frac{7}{8}$
7)34272
4896 quotient.

Note. If the numerator of the fraction be 1, *multiply the dividend by the denominator only,* (*as* 1 *will not divide*) *the product will be the true quotient.*

Case II. When the divisor is a mixed number.

Multiply its whole number by the denominator of the fraction, and to the product add the numerator, for a new divisor; multiply the dividend by the denominator of the fraction for a new dividend; divide this new dividend, by the new divisor; the result will be the true quotient.

Examples.

1. Divide 451174 by $7\frac{3}{5}$.

$7\frac{3}{5})451174$

5 quotient.

38)2255870(59365

190

355
342

138
114

247
228

190
190

2. Divide 43642 by $21\frac{5}{7}$.

$21\frac{5}{7})43642$

7 quotient.

153)305494(1996$\frac{106}{153}$

153

1524
1377

1479
1377

1024
918

106

Case III. When the dividend is a mixed number.

Multiply it by the denominator of the fraction; to the product add the numerator for a new dividend.

Multiply the divisor by the denominator of the fraction for a new divisor, then proceed as in the last Case.

Examples are needless.

Addition of Federal Money.

The denominations of Federal Money are expressed in the following Table.

TABLE.

10 Mills		1 Cent.
10 Cents	make	1 Dime.
10 Dimes		1 Dollar.
10 Dollars		1 Eagle.

Dollars and cents only are used in accounts, and are expressed thus, $ 45,73; read thus, 45 dollars and 73 cents.

NOTE 1. As there are only two places of figures in cents, and they are separated from the dollars by a comma or point, all the figures at the left of the comma or point, are dollars; thus $ 9364,56 are read 9364 dollars and 56 cents.

NOTE 2. As one cent is one hundredth part of a dollar, therefore when the number of cents is expressed by a single figure, as 6, 8, &c. it must occupy the unit's place in the column of cents, thus, $37, 26
42, 6
25, 8

But if a cipher should be prefixed, it would be better, and prevent mistakes which often take place. Thus,
$37, 26
42, 06
25, 08

RULE. Place the numbers so that each may stand under its like denomination, then proceed as in Simple Addition; observing to set the separating points in their proper places.

EXAMPLES in dollars, cents, and mills.

$ 73, 42, 5	$ 46, 37, 3	$ 562, 24, 3	$ 739, 01, 1
64, 37, 8	65, 28, 7	371, 36, 4	9, 10, 0
36, 29, 3	54, 41, 5	9, 81, 5	61, 27, 3
41, 64, 7	85, 93, 6	27, 00, 9	437, 59, 9
26, 57, 4	53, 62, 6	350, 00, 3	260, 98, 8
35, 62, 1	34, 71, 2	41, 07, 5	990, 80, 9
63, 70, 6	45, 58, 4	60, 10, 3	938, 72, 6
341, 64, 4			
268, 21, 9			
341, 64, 4			

EXAMPLES in dollars and cents.

$ 46, 38	$ 36, 21	$ 47, 36	$ 73, 61	$ 463, 81
73, 62	63, 12	51, 61	36, 48	9, 03
56, 47	51, 36	73, 28	52, 36	, 30
85, 23	48, 64	56, 37	29, 34	999, 91
53, 61	63, 78	52, 63	26, 38	536, 18

Questions for exercise.

1. A owes me $ 126,55 ; B, $ 64,36 ; C, $ 210,51 ; D, $ 93,46 ; what is the whole ?

Ans. $ 494, 88.

2. What is the sum of $ 46,26 ; $ 72,65 ; $ 49,37; and $ 136, 95 ? Ans. $ 305, 23.

3. I bought a farm, for which I owe $ 500, and have paid $ 967, 35 ; what was the whole value of the farm ?

Ans. $ 1467, 35.

4. The difference of two sums is $ 500, and the less sum is $ 967, 35 ; what is the greater sum ?

Ans. $ 1467, 35.

COMPOUND ADDITION

Teaches to collect numbers of diverse denominations into one sum.

RULE. Place the numbers so that each may stand under its like denomination. Begin with the lowest, and add that column as in Simple Addition ; divide the sum by as many of that denomination as make one of the next higher ; set the remainder underneath, and add the quotient to the next higher denomination ; proceed with that in the same manner ; and so on through all the denominations to the last, which add as in Simple Addition.

OF MONEY NOT DECIMALLY DIVIDED.

Accounts were formerly kept in pounds, shillings, pence and farthings, in the United States ; they are kept so in several countries with which we trade, which renders it necessary to keep this method in view.

The denominations are as in the following TABLE.

4 Farthings (or quarters) sometimes marked qr.	make	1 Penny,	marked d.
12 Pennies (or Pence)	„	1 shilling	„ s.
20 Shillings	„	1 Pound.	„ £.*

Farthings are commonly expressed thus, $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$ are called one farthing. two three farthings.

Great advantage will be derived by learning by heart the following tables.

Pence Table.

d.		s. d.
20	are	1 8
30		2 6
40		3 4
50		4 2
60		5 0
70		5 10
80		6 8
90		7 6
100		8 4
110		9 2
120		10 0

Shillings Table.

s.		d.
2	Also are	24
3		36
4		48
5		60
6		72
7		84
8		96
9		108
10		120
11		132
12		144

EXAMPLES.

£. s. d.	£. s. d.	£. s. d.	£. s. d.
46, 8, $9\frac{1}{2}$	37, 13, 3	73, 8, $4\frac{1}{2}$	591, 11, $6\frac{3}{4}$
31, 10, $3\frac{1}{2}$	42, 9, 6	36, 11, $7\frac{1}{4}$	9, 0, 0
62, 16, $4\frac{1}{2}$	81, 11, 4	25, 9, 6	, 3, $6\frac{1}{2}$
78, 5, $9\frac{3}{4}$	65, 14, 7	43, 6, $9\frac{3}{4}$	, , 9
53, 11, $2\frac{1}{4}$	62, 6, 8	26, 11, $7\frac{1}{4}$	408, 8, 5
68, 9, $8\frac{1}{2}$	57, 10, 5	63, 8, $4\frac{1}{2}$	990, 19, $11\frac{3}{4}$
37, 3, $7\frac{1}{4}$	18, 8, 7	74, 10, $5\frac{3}{4}$	999, 16, $5\frac{1}{4}$
sum 378, 5, 9			
331, 16, $11\frac{1}{2}$			
proof 378, 5, 9			

* When £ is prefixed to a sum, all the figures between it and the next separating point, are pounds; those between this point and the second separating point are shillings; those at the right of the second separating point are pence and farthings.

In the first example I begin with the farthings, and find by adding them together, they amount to 12, and as 4 farthings make 1 penny, the 12 will make 3 pence to carry, and no farthings remain to set down ; I therefore carry three to the pence, and add them up, finding the whole column of pence (including the 3 I carried) to be 45, which are 3 shillings and 9 pence ; I set the 9 under the pence, and carry 3 to the shillings, and add them up, find 65 shillings, which are 3 pounds and 5 shillings ; the 5 shillings I set under the shillings, and carry the 3 to the pounds, which I add up by columns, and carry for tens as in Simple Addition.

These examples are proved as in Simple Addition.

£.	s.	d.
46,	11,	3
65,	9,	6
73.	15,	9
49,	13,	4
50,	6,	7

£.	s.	d.
72.	9,	6
47,	16,	3
56.	7,	5
25,	3,	9
74,	16,	2

£.	s.	d.
48,	12,	$3\frac{1}{2}$
27,	9,	$4\frac{1}{2}$
56.	3,	$5\frac{1}{2}$
48,	11,	$6\frac{3}{4}$
51,	8,	5
37,	14,	$8\frac{1}{2}$

£.	s.	d.
69,	3,	$9\frac{3}{4}$
73,	11.	6
56,	13,	$7\frac{1}{2}$
48,	12,	$4\frac{1}{2}$
65,	11,	3
48.	13,	$4\frac{1}{2}$

£.	s.	d.
79,	9,	$3\frac{1}{2}$
46,	3,	$7\frac{1}{2}$
84.	11,	5
27,	13,	$8\frac{1}{2}$
72,	6,	$3\frac{1}{4}$

£.	s.	d.
46,	13,	$4\frac{3}{4}$
21,	7.	3
36,	9,	$6\frac{1}{4}$
48,	11,	3
51,	8,	$8\frac{3}{4}$

£.	s.	d.
65.	7,	3
37,	9,	$4\frac{1}{2}$
86,	11,	6
42,	6,	$9\frac{1}{2}$
57,	13,	$2\frac{1}{4}$

£.	s.	d.
46,	11,	$8\frac{1}{2}$
37.	3,	$9\frac{1}{4}$
50,	9,	0
74,	5,	$7\frac{3}{4}$
25,	14,	4

£.	s.	d.
71,	0,	$6\frac{1}{2}$
,	3,	0
,	,	$9\frac{1}{2}$
94,	0,	0
,	,	$\frac{3}{4}$

£.	s.	d.
69,	3,	$0\frac{1}{4}$
,	,	9
,	17,	0
,	,	4
1,	9,	$0\frac{3}{4}$

£.	s.	d.
93600,	17,	$6\frac{1}{2}$
,	3,	9
496,	0.	$7\frac{3}{4}$
,	9,	0
,	,	$\frac{1}{4}$

£.	s.	d.
,	,	9
,	,	$3\frac{1}{2}$
,	5,	6
,	6.	$9\frac{3}{4}$
1,	14,	6

NOTE 1. In England and France there are pieces of gold called guineas, of silver called crowns, &c. as also several imaginary, in those and other countries.

The following table exhibits some of them with their value in New England currency, (as formerly reckoned) and also in Federal Money.

	Names.	N. England Currency. £. s. d.	Federal money. $.
English, French,	Guinea.	1. 8. 0.	4. 66. 7.
		1. 7. 6.	4. 60. 0.
	Johannes.	4. 16. 0.	16. 00. 0.
	1-2 Johannes.	2. 8. 0.	8. 00. 0.
	Doubloon.	4. 8. 0.	14. 93. 3.
	Moidore.	1. 16. 0.	6. 00. 0.
Spanish, French,	Pistole.	1. 2. 0.	3. 77. 3.
		1. 1. 4.	3. 69. 9.
English and French.	Crowns.	0. 6. 7 3/7	1. 10. 0.
		0. 6. 7 1/7	1. 10. 0.
Spanish	Dollar.	0. 6. 0.	1. 00. 0.
English	Shilling.	0. 1. 4.	0. 22. 1.
Besides there were formerly in England, and still retained by some, the following imaginary denominations,			
	Jacobus.	1. 13. 4.	5. 55. 6.
	Carolus.	1. 10. 8 1/7	5. 11. 1.
	Mark.	0. 17. 5 3/7	2. 99. 6.
	Noble.	0. 8. 10 2/7	1. 48. 1.

NOTE 2. A great is generally understood to signify 4 pence, both in England, and the United States.

Articles which are bought and sold, by tale, are, staves, bricks, and nails; they are counted by casting three at a time; 40 casts are called 1 hundred, 10 hundred 1 thousand.

Twelve of some articles, as buttons, &c. are called 1 dozen, 12 dozen 1 gross, and 12 gross or 144 dozen, 1 great gross.

20 of some articles are called 1 score.

Some of the measures not usually inserted in Tables, are,

3 points, 1 line, } used in regulating the length of
12 lines, 1 inch, } the rods of clock pendulums.

4 inches, 1 hand; } used in measuring height of horses.
6 feet, 1 fathom; used in measuring depths at sea.
6120 feet, 1 geographical mile, } used in measuring
3 such miles, 1 sea league; } distances at sea.
60 such miles, 1 degree, of latitude, or of a great circle of the earth; the whole being 360 degrees.

Note. 60 *geographical miles are equal to* 69½ *English statute miles, which makes the whole circumference of the earth,* 25020 *statute miles; though but* 21600 *geographical miles.*

Troy Weight.

The denominations of Troy Weight are expressed in the following

TABLE.

24 grains, marked gr. make 1 penny-weight, marked dwt.
20 dwt. —— 1 ounce, —— oz.
12 oz. —— 1 pound Troy, —— lb.

By this weight, gold, silver, jewels, electuaries, and all liquors are weighed.

Examples.

lb.	oz.	dwt.	gr.	lb.	oz.	dwt.	gr.	lb.	oz.	dwt.	gr.	lb.	oz.	gr.
36	7	10	11	63	6	14	9	48	3	9	12			17
42	6	9	13	31	8	6	16	36	8	14	2		13	16
81	9	12	9	27	3	11	10	47					9	4
57	7	15	15	78	5	9	6		3	11	8	9	2	11
18	2	7	14	68	3	13	7	51	8	10	11	8	14	10
57	5	10	10	72	8	8	13	63	3	5	21	5	0	0
42	4	3	8	21	6	10	17	52	11	19	23	3	7	
336	7	10	8											
299	11	19	21											
336	7	10	8											

Avoirdupois Weight.

The denominations of Avoirdupois weight are expressed in the following Table.

TABLE.

				marked
16 drams,	marked dr.	make	1 ounce,	oz.
16 oz.		——	1 pound,	lb.
28 lb.	make	1 quarter of an hundred weight,		qr.
4 qrs.	—	1 hundred-weight,		C, or cwt.
20 C.	—	1 ton,		T.

A fother of lead	is 19 C, 2 qrs.
A great pound of silk,	24 oz.*
A stone of wool	7 lb.
of beef, or iron,	14 lb.
A faggot of steel,	120 lb.
A quintal of fish,	112 lb.

By this weight all coarse articles, or such as are of a drossy nature; as all grocery and chandlers' wares, and all metals, except gold and silver, are weighed.

Note I. The pound Avoirdupois is equal to 14 oz. 11 *dwt.* 15$\frac{1}{2}$ *gr. Troy; and the pound Troy is equal to* 13 *oz.* $=2\frac{9330}{13999}$ *dr. Avoirdupois.*

Note II. In this kind of weight, the words gross and net are used; gross is the whole weight of the goods, and of the box, bale, bag, cask, &c. which contains them.

Net weight is the pure weight of the goods, after deducting the weight of the box, bale, bag or cask, which contains them, and every other usual allowance.

Note III. The calling 112 *pounds a gross, and* 100 *pounds a net hundred, is (though somewhat a popular) but a vague distinction; as both gross and net weight are frequently expressed in pounds, ounces, &c. as well as in hundreds; as will be seen in the Rule of Tare and Tret.*

EXAMPLES.

lb.	oz.	dr.	lb.	oz.	dr.	C.	qr.	lb.	T.	C.	qr.	lb	oz.	dr.
46	7	6	73	9	6	47	2	11	41	11	1	16	5	10
21	8	7	36	7	8	36	3	9	25	9	2	11	9	6
53	6	9	42	6	9	81	1	16	58	6	1	9	6	9
75	9	9	65	8	11	59	2	21	43	12	3	16	8	11
53	8	9	26	6	9	52	1	16	58	8	2	11	10	5
78	7	8	63	8	7	63	0	18	74	10	1	16	6	9
46	9	6	57	9	6	18	2	11	41	13	2	18	9	6
375	9	6												

* Some kinds of silk are weighed by the great pound of 24 ounces.

Apothecaries' Weight.

The denominations of Apothecaries' Weight are expressed in the following

TABLE.

20 grains, marked gr.	make	1 scruple,	marked ℈
3 ℈	——	1 dram,	—— ʒ
8 ʒ	——	1 ounce,	—— ℥
12 ℥	——	1 pound,	—— lb.

This weight is used in compounding or mixing medicines, but never in buying or selling; it is therefore useless to all but such as deal in medicines. The pound, ounce and grain are the same in this, as in Troy weight; but the ounce differently divided, and subdivided.

EXAMPLES.

lb.	℥	ʒ	℈	gr.	lb.	℥	ʒ	℈	gr.	lb.	℥	℈	ʒ	gr.
36	7	3	1	10	47	3	5	0	15	73	6	5	1	11
43	5	4	0	11	35	5	3	2	11	36	4	2	1	16
61	3	1	2	8	29	2	6	1	9	41	5	4	0	13
76	9	5	1	15	84	7	2	2	16	27	3	3	1	10
63	4	4	1	9	52	8	2	2	4	26	5	2	1	8
56	6	3	2	8	64	6	4	0	8	53	7	5	1	3
38	8	6	0	11	70	9	1	1	10	58	6	3	2	6
376	9	5	1	12										

Long Measure.

The denominations of Long Measure are expressed in the following

TABLE.

3 barley corns, marked bc.	make	1 inch,	marked i.
12 i.	—	1 foot.	—— f.
3 f.	—	1 yard,	—— yd.
5½ yds. or 16½ f.	—	1 pole, perch or rod,	po.
40 po. or 220 yds. or 660 f.	—	1 furlong,	—— fu.
8 fu. or 320 po. or 1760 yds. or 5280 f.	—	1 English statute mile,	m.
3 m.	—	1 league,	Lea.

69½ statute miles, or 60 geographical miles, make one degree of a Great Circle of the Earth.

Note I. Mariners keep their account of the ship's run, &c. in geographical (by some called sea) miles; 60 of which are equal to 69½ English statute miles.

Note II. The English statute miles are used in the United States, for measuring distances on land; as roads, &c.

Examples.

yds.	f.	l.	in.
36	1	7	2
41	2	3	1
58	0	6	0
75	2	7	2
63	1	4	0
58	0	8	1
41	2	5	2
375	2	6	2

m.	fu.	po.
46	6	21
37	4	19
65	2	16
57	5	29
53	1	18
62	3	20
34	5	23

Lea.	m.	fu.	po.
37	1	3	17
46	2	6	16
74	0	2	26
37	1	6	31
62	1	4	22
53	0	1	23
25	2	5	13

yds.	f.	l.	in.
21	1	2	0
36	2	7	1
85	0	3	2
64	1	7	1
78	1	9	2
63	0	4	1
14	2	8	0

Cloth Measure.

The denominations of Cloth Measure are expressed in the following

TABLE.

2¼ inches,	make	1 nail,	marked na.
4 na.	——	1 quarter of a yard,	qr.
4 qrs.	——	1 yard,	yd.
3 qrs.	——	1 Ell Flemish,	E. Fl.
5 qrs.	——	1 Ell English,	E. En.
6 qrs.	——	1 Ell French, nearly,	E. Fr.

Note. The yard is used in measuring all kinds of woollen cloths, wrought silks, most linens, garterings, qualities, &c.

The Ell English is used in measuring some particular kinds of linens, called Hollands.

The Ell Flemish is used in measuring tapestry.

The Ell French is a measure used in some parts of France.

EXAMPLES.

rd.	yr.	ft.	E. Ft.	yr.	sx.	A. Ro.	yr.	sx.	E. Ft.	yr.	sx.
36	1	2	42	1	2	75	4	2	75	5	3
41	2	3	37	2	1	31	1	0	37	1	0
65	3	1	63	0	3	65	3	1	64	2	2
76	1	3	47	1	2	37	1	3	53	5	1
63	2	1	57	1	1	24	0	1	24	0	0
58	1	0	62	0	2	68	3	3	62	4	3
84	0	2	36	2	0	34	1	2	35	3	1
376	1	0									

Land Measure.

Land is commonly measured with Gunters' chain, of 100 links; each link being 7 inches, and 92 hundredth parts of an inch, which makes the whole chain 66 feet.

One pole, perch or rod, is a fourth part of a chain, equal to 25 links, or 16½ feet, or 5½ yards.

A rod in length, and the same in width, is called a square rod of land, &c.

A chain in length, and the same in width, is a square chain; and so of any other dimensions of equal length and width.

In a square rod, pole or perch, there are 625 square links, or 272¼ square feet.

In a square chain there are 16 square rods, or 10000 square links, or 4356 square feet.

In an acre of land there are 10 square chains, or 160 square rods, or 43560 square feet, or 100000 square links.

The most common denominations of Land Measure are expressed in the following

TABLE.

625 square links, marked li. make 1 square rod, pole or perch,	}	marked po.
40 po. make 1 rood, or ¼ of an acre,		r.
4 r. — 1 acre.		A.
10000 square links, marked li. make 1 square chain,		ch.
10 ch. 1 acre.		A

Note. The first part of this table is commonly used by surveyors, but the second is the best, and easiest to calculate by.

Examples.

A.	r.	po.	A.	r.	po.	A.	ch.	li.	a.	ch.	li.
46	3	26	75	1	16	46	4	9009	41	5	4361
25	1	31	36	2	11	64	5	3634	37	2	9
73	2	15	41	1	21	57	6	2914		3	61
64	1	17	75	3	34	73	9	9697		14	1521
53	0	13	24	2	23	53	5	999	58	4	3638
74	2	8	63	1	28	35	4	6368	62	7	9990
26	1	24	58	2	18	42	3	7089	99	4	9938
364	1	14									

Liquid Measure.

Liquid Measure is of two kinds, viz. Wine, and Beer or Ale Measure.

Wine Measure.

The denominations of Wine Measure are expressed in the following

TABLE.

4 gills, marked gi.	make 1 pint,	marked pt.
2 pts. or 8 gi.	1 quart,	qt.
4 qts.	1 gallon,	ga.
10 ga.	1 anchor of brandy,	An.
18 ga.	1 runlet,	Run.
31½ ga.	1 barrel,	Bbl.
42 ga.	1 tierce,*	Tier.
63 ga.	1 hogshead of wine,	Hhd.
84 ga.	1 puncheon of rum or brandy,	Pun.
2 hhd. or 126 ga.	1 pipe, or butt,	Pi.
2 Pi. or 4 Hhd. or 252 ga.	1 tun of wine, or oil,	T.

* Some casks are called tierces in the United States and elsewhere, which contain about 64 gallons.

The anchor and runlet are seldom used in the United States.

The wine gallon contains 231 solid (or cubic) inches, and is divided as above, into quarts, pints and gills.

EXAMPLES.

Hn.	ga.	qts.	Tier.	ga.	qts.	Hhd.	ga.	qt.	Pu.	ga.	qts.
36	3	1	47	20	3	64	41	1	47	39	3
41	6	2	31	16	2	36	27	3	73	45	1
73	5	1	65	19	1	57	36	2	65	70	2
64	7	1	74	27	3	58	60	1	84	36	1
63	6	2	52	21	0	35	21	2	52	44	0
58	3	1	68	25	1	63	35	0	26	38	2
26	4	2	34	22	2	42	26	1	34	13	1
364	6	2									

Beer and Ale Measure,

Called, in England, Winchester Measure.

The beer or ale gallon contains 282 solid (or cubic) inches; the denominations of this measure are expressed in the following

TABLE.

2 pints marked pt.	make 1 quart,	marked qt.
4 qts.	1 gallon,	ga.
8 ga.	1 firkin of ale,	fi.
9 ga.	1 firkin of beer,	fi.
2 fi.	1 Kilderkin,	ki.
2 ki. or 4 fi.	1 barrel of beer, bb. ale,	ab.
1½ bb. or 54 ga.	1 hogshead of beer,	hhd.

EXAMPLES.

hn.	fi.	gi.	qt.	AB.	ki.	fi.	ga.	qt.	Hhd.	ga.	qt.
46	2	1	3	64	1	0	3	2	56	31	2
65	1	3	1	36	0	1	4	1	63	27	1
74	2	5	2	73	1	0	6	2	42	26	3
46	3	4	1	56	0	1	4	1	37	16	1
53	1	7	0	35	0	1	4	1	43	22	1
34	2	5	2	63	1	0	3	2	36	25	2
25	1	3	1	26	0	1	1	1	57	26	0
346	3	3	2								

Dry Measure.

In a gallon, Dry Measure, are 268 solid (or cubic) inches, and eight tenths of an inch, expressed thus, 268,8.

The denominations of Dry Measure are expressed in the following

TABLE.

2 pints, marked pt.	make	1 quart,	marked qt.
2 qts.		1 pottle,	pot.
2 pot.		1 gallon,	ga.
2 ga.		1 peck,	pe.
4 pe.		1 bushel,	bu.
2 bu.		1 strike,	str.
2 str. or 4 bu.		1 coom,	Coo.
2 Coo. or 4 str. or 8 bu.		1 quarter of corn,	qr.
4 qrs. or 32 bu.	in most parts of England	1 chaldron of coals,	ch.
4½ qrs. or 36 bu.	make 1 chaldron	in London and the United States.	

Note I. As there are 8 gallons in a bushel, and each gallon is 268, 8 solid (or cubic) inches, it follows that the cubic inches in a bushel are = 268, 8 × 8=2150, 4 cubic inches, or in words, thus, two thousand, one hundred and fifty inches, and four tenths of an inch.

Note II. This measure is applied to corn, seed, fruit, roots, salt, sand, oysters and coals.

Examples.

bu.	pt.	bu.	pe.	ga.	pot.	qt.	ch.	bu.	pe.
36	3	64	2	1	0	1	46	21	3
21	1	31	1	0	0	1	31	19	1
42	2	73	0	0	1	1	85	23	2
72	1	64	3	1	0	0	27	16	3
63	0	35	1	0	1	0	53	14	0
78	2	68	0	1	1	0	68	16	2
51	1	26	2	1	0	0	34	12	1
372	2								

Superficial and Solid Measures used by Mechanicks, are most easily calculated by Duodecimals; under which head the learner will find a full explanation, for which reason they are omitted here.

Time.

The denominations of time are expressed in the following Table.

TABLE.

60 seconds, marked	sc.	make 1 minute, marked	m.
60 m.		1 hour,	h.
24 h.		1 day,	d.
7 d.		1 week,	w.
4 w.		1 month,	mo.

13 m. 1 d. and 6 h. make 1 Julian year; but 365 days, 5 hours, 48 minutes, and 48 by some 57 seconds, make 1 Tropical year.

Examples.

mo.	w.	d.
5	2	3
3	1	4
7	2	2
4	3	3
4	1	3
6	2	2
2	1	4
34	3	0

mo.	w.	d.
7	3	4
2	1	2
6	3	5
8	3	6
2	0	2
7	2	4
3	0	1
38	3	3

mo.	w.	d.	h.	m.	s.
7	3	4	12	31	26
1	2	3	16	29	31
1	1	2	11	30	29
6	2	3	15	26	27
2	0	2	11	28	33
8	1	3	7	39	28
8	2	4	12	29	30

Note I. The Kalendar months in common use are not divided into weeks as the foregoing table expresses, but contain some 30 days, some 31; and February but 28 days, except in Bissextile (or Leap year,) when it contains 29 days, which is in years divisible by 4, without a remainder.

Note II. Seamen and soldiers are paid by Kalendar Months; the broken (or fractional) parts of a month are computed at 30 days to the month.

Motion.

Motion is a kind of measure by which astronomers calculate the places of the stars, planets, comets, &c; geographers, the situation of places as to latitude and longitude; and mariners their latitude and longitude at sea.

The denominations of motion are expressed in the following Table.

TABLE.

60 fourths, marked $''''$	make	1 third, marked	$'''$
$60'''$		1 second,	$''$
$60''$		1 minute,	$'$
$60'$		1 degree,	°
30_{0}		1 sign,	s
12 s.		1 circle of the zodiac,	cir.

NOTE. In adding signs, reject all the twelves, and set down only the excess over even twelves; as twelve signs complete the circle, bringing to the point counted from.

EXAMPLE.

	S	°	′
The sun has passed the equinoxial point ♈	0.	22.	52
Mercury is east of the sun,	0.	18	34
Venus is east of mercury,	10.	05	36
Mars is east of venus,	0.	22.	07
Jupiter is east of mars,	9.	28.	52
Saturn is east of jupiter,	9.	17	18
Required the longitude of Saturn, or its distance from ♈. Answer,	6.	25.	19

Questions to exercise Compound Addition.

1. A man bought a ship, paid £. 736.19.6 in money, and gave a note for the balance, which was £ 163.0.6. how much was the ship valued at? Ans. £ 900.

2 A merchant bought sugar to the value of £ 350. brandy £. 256.9.7½, wine £. 364.11.6. rum, £. 536.9.4. how much did the whole come to? Ans. £ 1507.10.5 ½

3. Three men bought a lot of goods, which they divided in such manner that A had to pay £. 36. 9. 6, B, £.73, 8. 4, and C, £.236; what did the whole lot cost? Ans. £. 345. 17. 10.

4. Suppose I am indebted to A, twenty pounds, seven shillings, and four pence farthing, B, nineteen pounds, thirteen shillings and ten pence halfpenny, C, twelve pounds, fourteen shillings, and seven pence three farthings, D, twenty six pounds, seventeen shillings, and four pence farthing, E, twenty eight pounds, thirteen

shillings, and seven pence three farthings, F, twentyone pounds, fifteen shillings, and five pence halfpenny, G, five pounds, six shillings, and seven pence farthing; how much is the debt? Ans.

SUBTRACTION OF FEDERAL MONEY.

In Subtraction of Federal Money, proceed as in Simple Subtraction, through the whole, as if it had been all of one denomination; but observe the separating points, so as to have them in the same place in the remainder, as in the given sums.

The proof of this is the same as in Simple Subtraction.

EXAMPLES.

From	$ 46, 37	73, 61	64
Subtract	21, 05	36, 49	0, 49
Remains or difference.	25, 32		
Proof.	46, 37		

$ 375, 01	$ 47, 31	$ 5936, 41	$ 10000,
9, 56	99	4369, 92	9999, 99
365 45			

COMPOUND SUBTRACTION

Teaches to find the difference between two numbers of diverse denominations.

RULE. Place the less under the greater number, so that each may stand under its like denomination; begin with the lowest denomination, take the lower number from the upper, and set down the remainder underneath; but if the lower number be greater than the upper, take it from as many of that denomination as make one of the next higher, and to the remainder add

the upper number; set their sum underneath, observing in that case to add one to the lower number of the next higher denomination, with which proceed in the same manner, and thus through all the denominations, to the highest, which subtract as in Simple Subtraction. This is proved as Simple Subtraction.

Of Money.

£.	s.	d.
53	11	3
39	6	9
14	4	6

£.	s.	d.
48	13	$3\frac{1}{2}$
39	1	9

£.	s.	d.
65	9	6
31	16	$0\frac{3}{4}$

£.	s.	d.
79	9	$6\frac{1}{4}$
36	11	$3\frac{1}{2}$

£.	s.	d.
43	9	6
31	6	$9\frac{1}{4}$
12	2	$8\frac{3}{4}$

£.	s.	d.
65	11	$3\frac{3}{4}$
31	6	9

£.	s.	d.
41	13	$6\frac{1}{2}$
41	13	$6\frac{1}{2}$

£.	s.	d.
1000		
999	19	$11\frac{3}{4}$

Troy Weight.

lb.	oz.	dwt	gr.
96	7	13	11
37	9	11	16
58	10	1	19

lb.	oz.	dwt.	gr.
43	6	11	9
31	9	6	12

lb.	oz.	dwt.	gr.
100	11	19	23
99	11	19	23

Avoirdupois Weight.

lb.	oz.	dr.
36	7	10
21	9	7
14	14	3

lb.	oz.	dr.
56	10	3
41	9	12

C.	qr.	lb.
46	1	14
11	3	21

T.	C.	qr.	lb.	oz.	dr.
3	11	2	16	10	1
2	13	3	11	12	14

Apothecaries' Weight.

lb.	℥	ʒ	℈	gr.
46	7	4	1	10
31	9	2	2	13
14	10	1	1	17

lb.	℥	ʒ	℈	gr.
27	3	3	0	11
19	5	1	2	12

lb.	℥	ʒ	℈	gr.
43	5	2	2	14
31	9	2	2	15

Long Measure.

yd.	f.	l.
36	1	7
19	2	1
16	2	6

yd.	f.	l.
43	2	4
16	2	9

m.	fu.	po.
47	5	19
21	7	31

Lea.	m.	fu.	po.
26	1	3	25
11	2	5	16

Cloth Measure.

yd.	qr.	na.
36	1	2
11	3	1
24	2	1

E.Ea.	qr.	na.
46	3	1
31	4	2

E.Fl.	qr.	na.
85	1	3
37	2	1

E.Fr.	qr.	na.
56	1	2
11	5	3

Land Measure.

A.	r.	po.
47	1	16
11	3	26
35	1	30

A.	r.	po.
48	2	11
39	1	16

A.	r.	po.
84	3	16
27	3	29

A.	r.	po.
64	1	11
36	3	10

Wine Measure.

An.	gs.	qt.
56	4	1
39	5	3
16	8	2

Tier.	gs.	qts.
43	31	2
11	36	4

T.	Pi.	Hhd.	gs.	qts.
64	1	0	86	2
31	1	1	41	1

Pun.	gs.	qt.
75	36	1
36	59	2

Beer and Ale Measure.

Hhd.	ga.	qts.	BB.	ki.	fi.	ga.	qts.	BB.	ki.	fi.	ga.	qts.
47	32	3	63	1	0	13	2	87	0	1	5	3
21	43	1.	46	0	1	4	3	49	1	0	4	1
25	43	2										

Dry Measure.

bu.	pe.	qts.	bu.	pe.	ga.	pot.	qt.	Ch.	bu.	pe.	Ch.	bu.	pe.
56	3	2	48	2	1	0	1	75	25	3	65	11	1
39	2	3	31	2	0	1	0	46	30	1	37	19	3
17	0	3											

Time.

mo.	w.	d.	h.	m.	se.	days.	h.	m.	days.	h.	m.	se.
9	2	4	♈	31	47	117	13	48	365	5	48	48
4	3	4	19	31	49	96	16	29	365	5	48	47
4	2	6	21	59	58							

Motion.

S.	°	′	″	S.	°	′	″	S.	°	′	″	S.	°	′	″
3	21	36	47	7	16	37	11	5	21	49	36	5	29	3	21
5	19	31	56	2	11	11	29	7	16	19	43	5	29	3	20
10*	02	04	51												

What is the difference of latitude between London, in latitude 51°.32′ N. and Boston in Massachusetts, being in lat. 42°.23′ N.

Required the difference of longitude between Boston in longitude 71°.03′ W. and Cape Sable in Nova Scotia, in longitude, 65°.39′ W.

* In these examples the signs, degrees, &c. are counted from ♈ Aries; or rather from the beginning of Aries, 12 signs making the whole circle of the zodiac; therefore when the signs to be subtracted are a greater number than those from which they are to be taken, borrow 12. See the first example above.

Questions to exercise the learner in Compound Subtraction.

1. A man owed £.1136.15.9¼. has paid £ 735.18.10; how much remains unpaid? Ans £ 400. 16. 11¼

2. A man has paid £.400. 16. 11 ¼ of a debt of £.1136. 15. 9¼; how much has he yet to pay?
Ans. £.735 18. 10.

3. A farm of 200 acres consisted of mowing, pasture, ploughland; and 20 acres, 3 roods, and 16 perches of it is wood land; how much remains for mowing, pasture, and ploughland?
Ans. 179 acres and 24 perches.

4. A hogshead of tobacco, weighed 5 C. 2 qrs. 16 lb. including the weight of the hogshead, which weighed 3 qrs. 27 lb.; what was the net weight of the tobacco?
Ans. 4 C. 2 qrs. 17 lb.

5. An English guinea should weigh 5 dwt. 6 gr; a piece of gold weighs 3 dwt. 17 gr.; how much is it short of the weight of a guinea? Ans. 1 dwt. 13 gr.

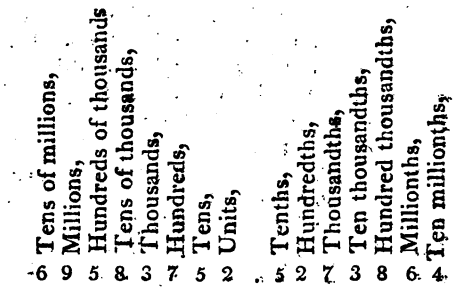
6. A man has travelled 25 miles, 3½ furlongs, on a journey of 75½ miles; how far has he yet to travel?
Ans. 50 miles, and 20 poles.

DECIMAL FRACTIONS.

Decimal Fractions are a part of Arithmetic, in which any thing which is called one, as one pound, one yard, one dollar, one mile, &c. is conceived to be divided into ten equal parts; and each of those parts into ten other equal parts, and so on by a decimal division, without end; those fractional parts called decimal fractions are distinguished from whole numbers (called integers) by having a point prefixed, or placed between them and the integers.

Thus ,2 is a decimal fraction, and is read two tenths; Also 56,75 is read fifty six, and seventy five hundredths, which will be better understood by the following table of

NOTATION OF DECIMALS.



In the above table, all the figures which stand at the left of the point, are integers (or whole numbers) and those at the right of it are decimals of one.

The first figure at the right of the point, taken alone, is called five tenths, i. e. if one is divided into ten equal parts, it is five of those parts.

If the two next figures at the right of this 5 be taken with it, they are called five hundred and twenty seven thousandths, &c.

Note I. Ciphers annexed to decimal fractions do not alter their value, as 5 *is five tenths;* 50 *is fifty hundredths;* 500 *is five hundred thousandths: and each of them equal to one half of one.*

Note II. Ciphers prefixed to decimals, diminish their value tenfold for each cipher so prefixed; as, ,5 *is five tenths,* ,05 *are five hundredths, and* ,005 *are five thousandths, &c.*

Note III. The point must always be prefixed to decimals, whether there are whole numbers at the left of them, or not; otherwise they may be mistaken for whole numbers: thus 56 *are fifty six, but* ,56 *are fifty six hundredths of one; the first of these being a whole number; the second a decimal fraction.*

A mixed number consists of whole and fractional numbers, thus, 5, 2 are five, and two tenths; 65, 03, are sixty five, and three hundredths.

Addition of Decimals.

Rule. Place the numbers according to their value, i. e. units under units, tens under tens, also tenths under tenths, hundredths under hundredths, &c. and then proceed as in Simple Addition; keeping the separating point in a perpendicular line.

Examples.

4637, 532	736, 3	26, 527	63, 5647
961, 003	9, 0006	3, 9036	, 5
93, 06	, 5	40, 5	, 0001
9, 6	5, 96	29, 472	, 006
5362, 467	263, 6999	73, 0963	36, 4352
9038, 996	990, 9993	96, 4999	99, 4999
9906, 939	999, 4999	59, 4729	99, 9998
30909, 597			

Subtraction of Decimals.

Rule. Place the numbers as directed in Addition, and then proceed as in Simple Subtraction.

Examples.

47, 036	,9	96,	47,	79,	96,
, 963	,3648	,96	,47	,79	,96
46, 073	,5352	95,04	46,53	78,21	95,04
9,	73, 4	10, 101	56, 3743	10,	
,9648	1, 637	9, 9	9,	9, 9999	

MULTIPLICATION AND DIVISION OF DECIMALS.

In Multiplication of Decimals.

Rule. Proceed in all respects as in Simple Multiplication, till the product is found; then point off as many decimal figures from the product, as there are in both factors taken together.

Note I. If there are not so many figures in the product, as there are decimal figures in both factors taken

together, prefix ciphers to them, till the number of places are supplied; and then prefix a point at the left of them, and the whole will be decimal fractions.

Note II. Any number, either whole, fractional, or mixed, when multiplied by a fraction only, the product will be less than the multiplicand, in the same proportion as the multiplier is less than one.

In Division of Decimals.

Rule. Proceed as in Simple Division, only observe, that the decimal places in the divisor and quotient, taken together, must be equal to those in the dividend; and if there are not so many figures in the quotient and divisor, taken together, as there are decimal places in the dividend, prefix ciphers to the quotient, till the number is complete, then prefix a point, and it will be the true quotient.

If there are more decimal places in the divisor, than in the dividend, annex ciphers to the dividend, till the number of decimals are equal; and then the quotient will be integers, or whole numbers: If there are remainders, and a more accurate quotient be required, annex as many ciphers to the remainder, as you would have decimal places in the quotient; and divide this augmented remainder; the quotient of which will be decimals.

Note. If any number, whole, fractional, or mixed, be divided by a decimal, the quotient will be greater than the dividend, in the same proportion as the divisor is less than one.

Examples.

Multiply 963,75
by 9,5

481875
867375

Product. 9155,625

Divide 96 by ,573.

,573)96,000(167,556 quot.
573
3870
3438
4320
4001
319000
2865
3250
2865
3850
3438
Remainder 412

Divide 9155,625, by 9,5.

9,5)9155,625(96375 quot.
855
605
570
356
285
712
665
475
475

and proof of the example in multiplication.

Proof by multiplication.

167,556
,573
502668
1172892
837780
Remainder 412 to add.
96,000000 proof.

Examples for exercise.

	Multiply	By	Product.
1	57	,0007	,0399
2	,06	,06	,0036
3	593,637	1,09	647,06433

	Divide	By	Quotient.
4	,0399	57	,0007
5	.0036	,06	,06
6	647,06433	593,637	1,09

Reduction of Decimals;
Or rather to reduce Vulgar to Decimal Fractions.

Rule. Set down the numerator as a dividend, and divide it by the denominator, (after annexing a compe-

tent number of ciphers to the numerator, or as many as you would have decimals.)

The quotient will be the decimal required, which, if there be no remainder, is exact, but if any remains, it is deficient, which frequently happens; the more decimal places are found, the nearer it approaches to a perfect decimal.

EXAMPLES.

Let $\frac{7}{25}$ be reduced to a decimal.

```
25)7,00(,25 Ans.        Proof by Multiplication.
   56                        ,25
  ---                        25
  140                       ---
  140                       200
  ---                       50
                           ---
                           7,00
```

Reduce $\frac{5}{9}$ to a decimal.

```
9)5,0000
  ------
  ,5555+5/9
     9
  ------
Proof. 5,0000
  ------
```

Here is a remainder of 5, and would be, if the division had been continued, without end. The decimal being found to four places, the remainder is only $\frac{5}{9}$ of $\frac{1}{10000}$, or five ninths of one ten thousandths.

Reduce $\frac{7}{8}$ to a decimal. Ans. ,875.

Here follow a number of Vulgar Fractions, with their decimals; those which are not perfect have this sign + annexed.

Vulgar fractions.	Decimal.	Vulgar fractions.	Decimal.
$\frac{4}{10}$	= ,4	$\frac{5}{8}$	= ,625
$\frac{3}{9}$	= ,3333+	$\frac{4}{7}$	= ,5714+
$\frac{6}{9}$	= ,6	$\frac{5}{7}$	= ,7142+
$\frac{4}{6}$	= ,6666+	$\frac{4}{9}$	= ,4444+
$\frac{6}{8}$	= ,375	$\frac{157284}{711312}$	= ,2281786+
$\frac{4}{16}$	= ,25	$\frac{16}{10648}$	= ,00155462+
$\frac{5}{12}$	= ,4166+	$\frac{5}{99999}$	= ,0000500005+
$\frac{104}{176}$	= ,53125	$\frac{3}{99999}$	= ,0000204165+

Reduction of Federal Money.

Federal money is decimally divided.

The learner having acquired a competent knowledge of decimals will readily see the propriety of the following rules, for reducing Federal Money.

Case I.

To reduce dollars to cents.

Rule. Annex two ciphers to the dollars, and the whole will be cents.

Examples.

Reduce $ 956 to cents.	Answer 95600 cents.
In $ 4736, how many cents?	473600
In $ 9735, how many cents?	973500

Case II.

To reduce dollars to mills.

Rule. Annex three ciphers to the dollars, the whole will be mills.

Note. This and case IX. prove each other.

Examples.

In $ 596, how many mills?	Answer 596000 mills.
In $ 7369, how many mills?	7369000
In $ 4362, how many mills?	4362000

Case III.

To reduce dollars and cents to cents.

Rule. Take away the separating point from between the dollars and cents, and the whole will be cents.

Note. This and Case VIII. prove each other.

Examples.

In $ 436,75, how many cents?	Answer 43675 cents.
In $ 964,31, how many cents?	96431
In $ 493,50, how many cents?	49350

Case IV.

To reduce dollars and cents to mills.

Rule. Take away the separating point, and annex a cipher.

EXAMPLES.

In $ 495,20, how many mills? Answer 495200 mills.
In $ 576, 37, how many mills? 576370
In $ 231, 49, how many mills? 231490

CASE V.

To reduce dollars, cents, and mills, to mills.

RULE. Take away both separating points.

EXAMPLES.

In $ 4739, 16, 4, how many mills? Ans. 4739164 mills.
In $ 537, 11, 2, how many mills? 537112
In $ 9364, 74, 3, how many mills? 4364743

NOTE. This and Case IX. prove each other.

CASE VI.

To reduce cents and mills, to mills.

RULE. Take away the separating point.

EXAMPLES.

In cents 36, 5, how many mills? Ans. 365 mills.
53, 7 537
75, 3 753

CASE VII.

To reduce cents to mills.

RULE. Annex a cipher.

EXAMPLES.

In 51 cents, how many mills? Ans. 510 mills.
47 470
99 990

CASE VIII.

To reduce cents to dollars.

RULE. Point off the two right hand figures for cents, the others will be dollars.

EXAMPLES.

In 43675 cents, how many dollars? Ans. $ 436, 75
In 96431 cents, how many dollars? 964, 31
In 49350 cents, how many dollars? 493, 50

NOTE. This Case, and Case III. prove each other.

Case IX.

To reduce mills to dollars.

Rule. Point off the right hand figure for mills, the next two for cents; the others will be dollars.

Examples.

In 4739164 mills, how many dols.?	Ans. $ 4739,16,4
537112	537,11,2
4364743	4364,74,3

Note. This and Case V. prove each other.

Reduction of Currencies, which are not decimally divided, as pounds, shillings, pence, &c. or of weights, measures, &c; as, tons, hundreds, quarters, &c; pounds, ounces, penny-weights, and grains, &c. Observe this one general rule.

1. If high denominations are to be reduced to lower, multiply the highest denomination given, by as many of the next lower, as make one of this highest.

2. If any figures stand in the place of the next lower denomination, they must be taken in, or added to the product, as in proving Division.

3. If it be required to reduce it still lower, multiply it by as many of the next lower denomination, as are equal to one of this last; and if any figures stand in the next lower to this, they must be taken in, or added to this product, as above, &c.

4. If low denominations, are to be reduced to high, divide the lowest given, by as many of that denomination, as are equal to one of the next higher.

5. If still higher be required, divide this quotient by as many of its denomination, as are equal to one of the next higher, &c.

6. If any figures remain in any of these divisions, they are so many of the same denomination, you was then dividing, which must be put each in its proper place, after the highest denomination required is obtained, and you will have the highest, and all its lower denominations in their due order.

Of Money.

EXAMPLES.

1. In £ 75, how many farthings?

75
20 shillings in a pound.

1500 shillings.
12 pence in a shilling.

18000 pence.
4 farthings in a penny.

72000 farthings, Ans.

2. In £ 36, 12, 6½ how many farthings?

36,12,6½
20 shillings in a pound.

732 shillings.
12 pence in a shilling.

8790 pence.
4 farthings in a penny.

35162 farthings, Ans.

3. In 72000 farthings, how many pounds?

farthings in a penny 4)72000

pence in a shilling 12)18000 pence.

shillings in a pound 2|0)150|0 shillings.

Answer £ 75

Note. This proves the first example.

4. In 35162 farthings, how many pounds?

farthings in a penny 4)35162

pence in a shilling 12)8790 ½

shillings in a pound 2|0)73|2 6

Answer, £ 36 12 6½

Note. This proves the second example.

5. Reduce 937246 farthings, to pounds.

Answer £ 97 12 7½

6. Reduce 73528 pence, to pounds.

Ans. £ 306 7 4.

7. In 936 shillings, how many farthings?

Ans. 44928.

8. In £ 964, how many six-pences? Ans. 38560.

Note. According to the preceding Rule, this last example is to be multiplied by 20, *to bring it into shillings; and then (as there are* 2 *six-pence in one shilling, these shillings are to be multiplied by* 2. *But as there are* 40 *six-pences in a pound, it may be more speedily performed, by multiplying the pounds by* 40.

9. In £ 86 16, how many six-pences, three-pences, pence, and farthings?

Ans. { 3472 six-pences. 6944 three-pences. 20832 pence. 83328 farthings.

10. In £ 53 4 5, how many eight-pences, four-pences, pence, and farthings; and the number of each equal? Answer, 964 of each.

Note. To answer this question, reduce the given sum to farthings, and divide those farthings by as many as there are farthings, in one of each of the required denominations, when added together.

11. Reduce £ 57 11 7¼ to six-pences, three-pences, pence and farthings, and let the number of pence be double the number of farthings; the three-pences, double the number of pence; and the six-pences double the number of three-pences.

Ans. 222 farthings, 444 pence, 888 three-pences, and 1776 six-pences.

12. In £ 120 12 3, how many three-pences?

Ans. 9649.

In £ 17 6 8, how many eight-pences? Ans. 520.

13. In £ 97 12 7¼, how many farthings?

Ans. 937246.

14. In £ 306 7 4, how many pence? Ans. 73528.

15. In 44928 farthings, how many shillings?

Ans. 936.

16. In 38560 six-pences, how many pounds?

Ans. £ 964.

17. How many pounds are there in 3472 six-pences; in 6944 three-pences; in 20832 pence: Or, in 83328 farthings?

Answer. In either of these sums, there are £ 86 16.

18. In the sum of 964 eight-pences, 964 four-pences, 964 pence, and 964 farthings, how many pounds?

Ans. £ 53 4 5.

19 In 222 farthings, 444 pence, 888 three-pences, and 1776 six-pences, how many pounds?

Ans. £ 37 14 7½.

20. In 520 eight-pences, how many pounds?

Ans. £ 17 6 8.

Note. From the 13th to the 20th example inclusive, will be found the proof of those from the 5 to 12 inclusive.

Of Troy Weight.

1. In 63 lb. 7 oz. 10 dwt. 11 gr. how many grains?

63	7	10	11	
			12	
			763	
			20	
			15270	
			24	
			61091	
			30540	
			366491	Ans.

2. In 366491 grains, how many pounds?

		20
24)366491(1527		0
24		
	12)763,	10
126		
120	Ans. 63,	7, 10, 11
64		
48		
169		
168		
11		

3. In 47 lb. 10 oz. how many grains? Ans. 275520 gr.

4. In 8 lb. 2 oz. 3 dwt. 16 gr. how many grains?

Ans. 47128 gr.

5. In 9 lb. 7 oz. 10 dwt. of silver, how many spoons, each 5 oz. 10 dwt? Ans. 21 spoons.

6. In 9 oz. 10 dwt. of silver, how many tea spoons, each half an ounce? Answer 19.

7. A goldsmith having 3 ingots of silver, each weighing 26 oz. 13 dwt. 8 gr. to be made into spoons of 2 oz. cups of 5 oz. salts of 1 oz. and snuff-boxes of 2 oz. and to have an equal number of each; what number will the siver make? Ans. 8 of each.

8. In 275520 grains of silver, how many pounds?

Ans. 47 lb. 10 oz.

9. In 47128 grains of gold, how many pounds ?
Ans. 8 lb. 2 oz. 3 dwt. 16 gr.

10. In 21 silver spoons, each weighing 5 oz. 10 dwt. how many pounds ? Ans. 9 lb. 7 oz. 10 dwt.

11. In 19 tea spoons, each half an ounce, how many ounces ? Ans. 9 oz. 10 dwt.

12. How many ingots of silver, weighing each 26 oz. 13 dwt. 8 gr. will be sufficient to make spoons of 2 oz. cups of 5 oz. salts of 1 oz. and snuff-boxes of 2 oz. and to have 8 of each ? Ans. 3 ingots.

Note. The 5 last prove the 5 preceding examples.

Of Avoirdupois Weight.

1. In 7 cwt. 3 qrs. 10 lb. how many ounces and drams ?

7, 3, 10
4
—
31 qrs.
28
—
258
62
—
878 lb.
16
—
5268
878
—
14048 oz.
16
—
84288
14048
—
Ans. 224768 dr.

2. Reduce 224768 drams to hundreds.

16 28 4
16)224768(14048(878(31
16 128 84 —
— — — 7, 3, 10
64 124 38 C. qr. lb.
64 112 28
— — —
76 128 10
64 128
— —
128
128
—

Note. This proves the first example.

3. Reduce 3 tons of iron to drams. Ans. 1720320 dr.

4. In 8 cwt. 3 qrs. 16 lb. how many ounces ?
Ans. 15936 oz.

5. In 461 great pounds,* of raw silk, how many drams? Ans. 177024 dr.

6. In 3 lb. of cinnamon, how many parcels, each 15 oz? Ans. 4 parcels.

7. In 109 cwt. 0 qr. 12 lb. of sugar, how many parcels, each 36 lb? Ans. 470 parcels.

8. Reduce 1720320 drams to tons. Ans. 3 tons.

9. Reduce 15936 ounces, to hundreds. Ans. 8 cwt. 3 qrs. 16 lb.

10. In 177024 drams of raw silk, how many great pounds? Ans. 461 great pounds.

11. In 4 parcels of cinnamon, each 12 ounces, how many pounds? Ans. 3 lb.

12. In 470 parcels of sugar, each 26 pound, how many hundreds, &c. Ans. 109 cwt. 0 qr. 12 lb.

Note. These 5 last prove the 5 preceding examples.

13. In 240 great pounds, how many common pounds?

240
3
2)720
Ans. 360

14. In 360 common pounds, how many great pounds?

360
2
3)720
Ans. 240

Of Apothecaries' Weight.

1. In 12 lb. 1℥ 2℈ 0℈ 1 gr. how many grains? Ans. 69721 gr.

2. In 69721 grains, how many pounds? Ans. 12 lb. 1℥ 2℈ 0℈ 1 gr.

Of Long Measure.

1. In 70 miles, how many poles? Ans. 22400 po.
2. Reduce 36 yards to barley corns. 3888 bc
3. In 56 poles, how many inches? 11088 inches.
4. Reduce 2 m. 5 fu. 30 po. to feet. 14355 feet.

* The common pound being 16, and the great pound 24 ounces, the proportion is as 2 to 3; therefore,

To bring common pounds, to great pounds, multiply by 2, and divide by 3; and contra, to bring great, to common pounds, multiply by 3, and divide by 2.

5. Reduce 22400 poles to miles. Ans. 70 m.
6. Reduce 3888 barley-corns, to yards. 36 yards.
7. In 11088 inches, how many poles? 56 poles.
8. In 14355 feet, how many miles?
Ans. 2 m. 5 fu. 30 po.

Note. These 4 last prove the 4 preceding examples.

Of Cloth Measure.

1. Reduce 47 yd. 2 qrs. to nails. Ans. 760 nails.
2. In 60 Ells English, how many yards? Ans. 75 yds.
3. In 96 Ells Flemish, how many Ells English?
Ans. 57 Ells, and 3 qrs.
4. In 57 Ells English, how many Ells Flemish?
Ans. 95 Ells Flemish.
5. In 760 nails, how many yards?
Ans. 47 yd. 2 qrs.
6. In 75 yards, how many Ells English?
Ans. 60 Ells English.

Of Land Measure.

1. In 40 acres, how many perches?
Ans. 6400 perches.

2. If a piece of land contains 24 acres, and an enclosure of 17 acres, 3 roods, be taken from it, how many perches are there in the remainder? Ans. 1000 perches.

3. One field contains 7 acres, another 10 acres, a third 11 acres, 3 roods, 36 perches; how many parcels of 76 perches each, are contained in the whole?
Ans. 61.

4. A man has a lot of land containing 100 acres, on which is a garden of 1 acre; an orchard of 10 acres; plough land 10 acres, 3 roods, 16 perches; mowing 20 acres, and 7 perches; pasture, 30 acres, 1 rood; how many perches are in these several parcels, and how many perches are in the remainder, which is wood land?
Ans. { The several parcels contain 11543 / The remaining wood land, 4457 } perches.

5. A field lying in form of a parallelogram measures in length 40 chains, and 75 links, and in width 26 chains and 45 links; what is its contents?

40 75
26 45

203 75
1630 0
24450. Ans. 107 A. 3 r. 5,4 po.
8150

107|78375
4
3|13500
40
5|40000

Of Wine Measure.

1. In 17 gallons, how many pints? Ans. 136.
2. In 4 tuns, how many hogsheads, gallons, and quarts.

Answer, { 16 Hhd. / 1008 ga. / 4032 qts.

3. Reduce 136 pints to gallons. Ans. 17 ga.
4. Reduce 4032 quarts to gallons, hogsheads, and tuns.

Answer, { 1008 ga. / 16 Hhd. / 4 T.

Of Beer or Ale Measure.

1. In 4 barrels of ale, how many gallons?
Answer 128 ga.
2. In 72 hogheads of beer, how many barrels?
Ans 108 bl.
3. In 90 barrels of beer, how many hogsheads?
Ans. 60 Hhd.
4. Reduce 128 gallons of ale to barrels. Ans. 4 bl.
5. Reduce 108 barrels of beer to hogsheads.
Ans. 72 Hhd.
6. Reduce 60 hogsheads of beer to barrels.
Ans. 90 bls.

Of Dry Measure.

1. In 30 chaldrons of coals, how many pecks?
Ans. 4320.

2. Reduce 49 chaldrons of coals, to pecks.
Ans. 7056.
3. Reduce 4320 pecks of coals, to chaldrons.
Ans. 30.
4. Reduce 7056 pecks of coals, to chaldrons.
Ans. 49.

Of Time.

1. In 25 years,* how many seconds?
Ans. 788940000.
2. Reduce 7 weeks, 3 days, 9 hours, 37 minutes, 12 seconds, to seconds. Ans. 4527432.
3. Reduce 788940000 seconds, to years.*
Ans. 25.
4. Reduce 452732 seconds to weeks.
Ans. 7 w. 3 d. 9 h. 37 m. 12 S.

Of Motion.

1. Reduce 360 degrees, to seconds.
Ans. 1296000.
2. In 131 degrees, how many minutes and seconds?
Ans. 7860 minutes, or 471600 seconds.
3. Reduce 1296000 seconds to degrees. Ans. 360.
4. Reduce 471600 seconds to degrees. Ans. 131.

Miscellaneous Questions to exercise the learner in Reduction of Money, Weights, Measures, &c.

1. In £ 72 18 9, how many pieces of $4\frac{3}{4}$ each?
Ans. 3890.
2. In £ 72 12, how many pistareens, of 1s. $2\frac{2}{3}$d.?
Ans 1210.
3. In $ 4334, how many crowns, 6s. $7\frac{1}{2}$ d. each?
Ans. 3940 crowns.
4. In 2875 guineas of 28s. 8d. how many crowns of 6s. $7\frac{1}{2}$d. each? Ans. $12487\frac{148}{366}$.
5. In £ 150, how many pieces of 5s. 9d.—3s. 9d.—2s. 3d.—1s. $10\frac{1}{2}$d.—$11\frac{1}{4}$d.—3d.—and $2\frac{1}{4}$d. of each an equal number? Ans. 200.

* In these examples the year is called 365 days, and 6 hours.

6. In 870 crowns of 6s. 7½ d. how many dollars?
Ans. 957.

7. How many pieces of 27s. are there in 3240 pence?
Ans. 10.

8. In 21 purses, in each 21 guineas of 21s. sterling, a crown of 5s. and a moidore of 27s. what do they contain in sterling? Ans. £ 496 13.

9. In 241056 grains of silver, how many ingots of 6lb. 11oz. 14 dwt. each? Ans. 6 ingots.

10. How many pounds of silver are there in one dozen dishes, each weighing 25oz. and 15 dwt. and one dozen of plates, each weighing 15oz. 15 dwt. 22 gr.
Ans. 41lb. 6 oz. 11 dwt.

11. How many hogsheads of sugar, each weighing 11½ C. are there in 12880 pounds? Ans. 10Hhd.

12. How many fother of lead in 507 C? Ans. 26.

13. How many cannisters of 12 lb. each can be filled out of 12 C. 3 qrs. 12 lb. of tea? Ans. 120.

14. How many parcels of 6 lb. 8 lb. 12 lb. and 16 lb. and an equal number of each can a grocer have out of two hogsheads of tobacco, each weighing neat 4 C. 3 qrs. 24 lb. Ans. 26 parcels of each, and 20lb. over.

15. In 4 bales of cloth, each 12 pieces, and each piece 24 Ells Flemish, how many Ells English?
Ans. 691 E. En. and 1 qr.

16. How many shirts, to contain 3½ yards each, can be made with 19 pieces of linen, each 27¼ yards?
Ans. 147$\frac{13}{17}$ shirts.

17. A boat of 37½ feet keel, sets out from Boston long wharf, for the lighthouse, with a fair wind; how many times the length of her keel will she run, before she arrives, it being 9 miles. Ans. 1267½.

18. Suppose West-Boston bridge 212 rods in length; how many times will a chaise wheel turn round in passing over it, that is 18½ feet round, or in circumference?
Ans. 189$\frac{3}{37}$.

19. In 2985586560 barley corns, how many degrees of 69½ miles each? Ans. 226.

20. In 17 pipes of wine, each 126 gallons, how many kegs of 15¼ gallons each? Ans. 140$\frac{28}{61}$.

21. In 344894773 gills of wine, how many tuns, &c.
Ans. 42769 T. 2 Hhd. 47 ga. 2 qts. 5 gi.

22. How many seconds are there since the birth of Christ to the 25 December, A. D. 1808, allowing the year to consist of 365 days, 5 hours, 48 minutes, 48 seconds? Ans. 57054925824.

Multiplication of Federal Money

Teaches how, from the price of 1 yard, &c. given in Federal Money, to find the price or value of any number proposed.

Rule. Consider the given price in it lowest denomination. Multiply the price of one, by the number given, or proposed, the product will be the value of the whole, in the lowest denomination used, and may be reduced as has been taught.

Note. The same cases apply here, as in Simple Multiplication, only observe to set the separating points in their proper places in the product, which reduces it to its proper terms.

Examples.

1. What is the value of 7 acres of land at $10,36.

$10,36
7
72,52

2. What is the value of 26 yards of linen at $1,22,3. per yard?

$ 1,22,3
26
7,33,8
24,46
31,79,8

Note. Multiplication of Federal Money may be proved by casting out the nines, as in Simple Multiplication.

3. What is the value of 27 yards of broadcloth, at $5,75 per yard? Ans. $212,75.

4. What is the value of 4 dozen of buttons, at $0,55,3, per dozen? Ans. $2,21,2.

5. 90 gallons of brandy at $1,07,5 per gallon? Ans. $96,75.

6. 526 quintals of fish, at $3,57, per quintal? Ans. $1913,52.

7. 26 hogsheads of lime, at $3,65 per hogshead? Ans. $94,90.

8. What is the value of 84 pounds of tea, at $1,36 per lb.? Ans. $114,24.

9. 3 hogsheads of tobacco, each weighing neat 5 C. 2 qr. 17 lb. at 5½ cents per lb? Ans. $104,44,5.

10. 15 hogsheads of sugar weighing each 12 C. 1 qr. 16 lb. neat, at 5 cents per lb? Ans. $1041.

11. 35 tons of hay, at 75 cents per cwt?
Ans. $525.

12. 57 yards at 37 cents? Ans. $21,09.

13. 9 pounds of coffee, at 33 cents? Ans. $2,97.

14. 5 barrels of sugar containing 2 C. 1 qr. 15 lb. each at 7 cents per lb? Ans. $93,45.

15. 25 bushels of wheat, at $1,12½?
Ans. $28,12½.

When articles are sold by the thousand, and have thousands, hundreds, &c. given.

Multiply the price of one thousand, by the thousands, hundreds, &c. given, point off the three right hand figures for decimals, the others will be the whole value in the lowest denomination mentioned at the given price, which may be reduced by the preceding rules.

EXAMPLES.

1. 25374 feet of boards, at $7,50.

25374
7,50*

1268700
177618

$190,30,5,00 Ans.

2. 46487 feets of boards, at $6,75,5 per thousand?
Ans. $314,01,9 ,685.

3. 22736 bricks, at $5,55 Ans. $126,18,4 ,80.

4. 237385 bricks, at $6,25
Ans. $1483,65,6 ,25.

When the given quantity is a fraction, as ¾, ⅞, &c.

Multiply the price of one by the numerator of the fraction, and divide the product by the denominator.

* There being more figures in the number of the article, than in the price, the latter is set under the former, as a multiplier, the result is the same, and the operation easier.

If the numerator is 1, as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. divide the price of one, by the denominator, the quotient will be the answer in either case.

EXAMPLES.

1. What is the value of $\frac{3}{4}$ of a yard of cloth, at $4,25 per yard?

4, 25
$\frac{3}{4}$

4)12, 75

Ans. $3, 18, 7, 5 or $3, 18, 7$\frac{1}{2}$

2. $\frac{1}{8}$ of a ton of timber at $3, 50.

8)3 50
$\frac{1}{8}$

$0, 43, 7, 5 or 43 cents 7$\frac{1}{2}$ mills.

3. $\frac{7}{8}$ of a ton of hay, at $18,56. Ans. $16,24.

4 $\frac{5}{8}$ of a gallon of brandy, at $1,28. Ans. 1,06,6 +

5. $\frac{1}{9}$ of an acre of land, at $17,66. Ans. 1,96,2 +

NOTE. These questions may be proved by a contrary process, i. e. multiply the answer by the denominator, and divide the product by the numerator, the quotient will be the value of one.

When the given quantity is a mixed number, as $3\frac{1}{4}$, $26\frac{1}{2}$, &c.

Proceed with the fractions as above directed, then multiply the given price by the integer, and add the quotient and product together, their sum will be the value required.

EXAMPLES.

1. What is the value of $26\frac{1}{4}$ bushels of wheat, at $1,25 per bushel?

$1, 25
$26\frac{1}{4}$

4)3, 75

93, 7, 5
7, 50
25, 0

$33, 43, 7, 5 Ans.

NOTE. These questions may be proved by a contrary process; see division of Federal Money, with mixed numbers.

2. What is the value of $375\frac{1}{2}$ bushels of salt, at 75 cents? Ans. $ 281,62,5.

3. $9\frac{7}{8}$ yards of cloth, at $ 4,50?

Ans. $ 44,43,7 ,5.

Questions for exercise in Multiplication of Federal Money.

1. What is the value of 4 dozen of buttons, at 55 cents, 3 mills? Ans. $ 2,21,2.

2. 90 gallons of brandy, at $ 1,07,5?

Ans. $ 96,75.

3. 536 quintals of fish, at $ 3,57?

Ans. $ 1913,52.

4. 26 hogsheads of lime, at $ 3,65?

Ans. $ 94,90.

5. 84 lb. of tea, at $ 1,36? Ans. $ 114,24.

6. 3 hogsheads of tobacco, each weighing neat 5 C. 2 qrs. 17lb. at $5\frac{1}{2}$ cents per lb? Ans. $ 104,44,5.

7. 15 hogsheads of sugar, weighing each neat 12 C. 1 qr. 16 lb. at 15 cents per lb.? Ans. $ 3123.

8. 35 tons of hay, at 75 cents per cwt?

Ans. $ 525.

9. 57 yards, at 37 cents per yard? Ans. $ 21,09.

10. 9 lb. coffee, at 33 cents per lb? Ans. $ 2,97.

11. 5 barrels of sugar, containing each, 2 C. 1 qr. 15 lb. neat, at 7 cents per lb? Ans. $ 93,45.

12. 12 C. 3 qrs. of sugar, at $ 10,50 per cwt?

Ans. $ 133,87,5.

13. $9\frac{1}{2}$ C. of iron, at $ 4,25? Ans. $ 40,37,5.

14. $5\frac{7}{8}$ yards of cloth, at $ 3,75? Ans. $ 22,03,$1\frac{1}{8}$.

15. $95\frac{3}{4}$ acres of land, at $ 7,36? Ans. $ 704,72.

16. $11\frac{4}{10}$ tons of hay, at $ 18,40? Ans. $ 209,76.

17. $46\frac{7}{8}$ bushels of salt, at 47 cents?

Ans. $ 22,03,$1\frac{3}{8}$.

18. Delivered to a purchaser at sundry times, the following quantities of wheat, at $ 1,25 per bushel, viz. $46\frac{3}{4}$ bushels, $72\frac{1}{4}$, $69\frac{1}{4}$, $56\frac{3}{4}$, $73\frac{3}{4}$ bushels; what is the value of the whole? Ans. $ 398,43,$7\frac{1}{2}$.

Compound Multiplication

Teaches to multiply a number of diverse denominations, by a simple number, a fraction, or a mixed number, and is used to find the value of any number of articles bought or sold, by having the number, and the price of one given, in money, which is not decimally divided, as pounds, shillings, pence, &c.

Case I. When the given number does not exceed 12.

Rule. Begin with the lowest denomination in the given price; multiply it, and all the denominations by the given number, carrying from the product of one, to that of another, as in Compound Addition.

This Case is proved by Case I. in Compound Division.

Examples.

1. Sold 3 gallons of rum for 5s. 9d. per gallon; what does it come to?

5 9
3

17s3d. Ans.

2. What is 7 yards of cloth worth, at £ 1 3 $7\frac{1}{2}$ per yard?

£ 1 3 $7\frac{1}{2}$
7

Ans. £ 8 5 $4\frac{1}{2}$

3. Required the value of 9lb. of tea, at 7s. $3\frac{1}{4}$d.
Ans. £ 3 5 $5\frac{1}{4}$.

4. 11 barrels of tar, at 15s. $7\frac{1}{4}$, per barrel.
Ans. £ 8 11 $7\frac{3}{4}$.

5. At £ 23 6 $0\frac{1}{2}$ per hogshead, what will 12 such hogsheads cost? Ans. £ 279 12 6.

6. At $1\frac{1}{2}$d per yard, what will 11 yards of tape cost?
Ans. 1s. $4\frac{1}{2}$d.

7. 10 gallons of brandy, at 5s. $11\frac{1}{4}$d? Ans. £ 2 19 $9\frac{1}{2}$.

8. Bought 8 barrels of flour, at £ 1 19 $6\frac{1}{2}$, per barrel; what did the whole cost? Ans. £ 15 16 4.

CASE II. When the given quantity exceeds 12, and can be found in the multiplication table.

RULE. Take the two numbers, which produce it, multiply the given price by one of those numbers, and that product by the other; the second product will be the value of the whole.

This Case and Case II. of Compound Division prove each other.

EXAMPLES.

1. 35 bushels of wheat, at 7s. 3¼d. per bushel?

7 times 5 are 35.

	7	3¼
		7
2	10	10¼
		5

Ans. £ 12 14 5¼

2. 108 acres of land, at £ 16 11 3¼ per acre? Ans. £ 1789 1 9.

3. 84 gallons of brandy, at 5s. 7½d? Ans. £ 23 12 6.

4. 144 pounds of cheese at 9d? Ans. £ 5 8.

5. 70 bushels of wheat, at 7s. 3¼d? Ans. £ 25 8 11½.

6. What is the value of 132 bushels of salt, at 4s. 9d. per bushel? Ans. £ 31 7.

7. 64 gallons of brandy, at 5s. 2½d. per gallon? Ans. £ 16 13 4.

CASE III. When the given number exceeds 12, and cannot be found in the multiplication table exactly, but near it.

RULE. Take those two numbers which produce one the nearest to the given number; proceed with them as in Case II. till the second product is found. Then if these two numbers produce one less than the given number, multiply the price of one, by the number deficient, and add this product to the second; but if the two produce a number greater than that given, multiply the price of one by the excess, and subtract this product from the second, and you will have the value of the whole.

This, and Case III. of Compound Division, prove each other.

EXAMPLES.

1. What is 26 yards of silk worth, at 9s. 6½d per yard?

5 times 5, are 25.

	9	6½	
		5	
value of 5 yds.	2	7	8½
		5	
value of 25.	11	18	6½
value of 1.		9	6½
value of 26.	£12	8	1 Ans.

2. 46 barrels of flour, at £1 8 6½? Ans. £65 12 11.

3. 76 yards of linen, at 4s. 8¼d. per yard? Ans. £17 19 5.

4. 68 hogsheads of lime, at £1 1 6¼? Ans. £73 3 5.

CASE IV. When the given quantity is any number of hundreds, less than 13, as 500, 900, &c.

RULE. Multiply the price of one by 10, and that product by 10, then multiply this second product by the number of hundreds; this third product will be the whole value sought.

NOTE. When the price is very small, reduce it to the lowest denomination mentioned, for a multiplier, by which multiply the given quantity; the product will be the value of the whole in the same denomination, the price is reduced too, and may be reduced to its proper terms.

This and Case IV. of Compound Division prove each other.

EXAMPLES.

1. Required the value of 700 lb. of coffee. at 1s. 7¼d. per lb.

	1	7¼	
		10	
	16	0½	
		10	
	8	0	5
			7
Ans. £	56	2	11

2. What is 1200 lb. of chocolate worth, at 2s. 3½d. per lb ? Ans. £137 10.

3. Sold 1100 lb. of tea. at 7s. 2½ per lb. what does the whole come to ? Ans. £ 396 9 2.

4. 800 lb. of sugar, at 7½d. per lb ? Ans. £ 25.

NOTE. Examples in this fourth case may be proved by Compound Division, Case IV. which see.

CASE V. When the given quantity is over hundreds, as 212, 562, &c.

RULE. Proceed as in Case IV. to find the value of the hundreds ; then proceed as in the former Cases, to find the value of the excess over hundreds, and add it to the value of the hundreds ; their sum will be the whole value sought.

NOTE. When the price is very small, proceed as directed in note to last case.

EXAMPLES.

1. Required the value of 736 acres of land, at £ 1 7 6 per acre.

	1	7	6		1	7	6
			10				6
	13	15	0		8	5	0
			10				6
	137	10	0	value of 36 =	49	10	0
			7				
value of 700 =	962	10	0				
value of 36 =	49	10	0				
value of 736 £	1012	0	0	Ans.			

NOTE. This case may be proved by Case III. of Compound Division.

2. What is the value of 648 barrels of flour, at £ 1 18 4 per barrel ? Ans. £ 1248.

3. 999 lb. of coffee, at 1s. 7½ ? Ans. £ 81 3 4½.

4. 758 gallons of rum, at 5s. 1½d. per gallon ? Ans. 194 4 9.

CASE VI. When the given quantity is any number of thousands, less than 13, as 4000, 7000, &c.

RULE. Multiply the price of one by 10, that product by 10, and the second product by 10, then multiply the third product by the number of thousands; the fourth product will be the value of the whole: Or,

NOTE. If the price is very small, proceed as directed in the note, to Case IV.

EXAMPLES.

1. Required the value of 9000 quintals of fish, at 12s. 9d. per quintal.

12	9	
	10	
6	7	6
	10	
63	15	0
	10	
637	10	0
	9	
Ans. £ 5737	10	0

2. What is 12000 lb. of coffee worth, at 1s. 9½d. per lb? Ans. £ 1075.

3. 7000 gallons of wine, at 5s. 7¼ per gallon?
Ans. £ 1961 9 2.

4. 11000 bushels of wheat, at 6s. 8d. per bushel?
Ans. £ 3666 13 4.

CASE VII. When the given quantity is a number of hundreds, or of thousands, over 12, which are expressed in the multiplication table, as 2100 35000, &c.

RULE. Find the value of 100, or 1000 (as the case may be) by the foregoing cases, then take the two numbers, which produce the number of hundreds, or of thousands, and multiply the value of one hundred, or of one thousand, by one of those numbers, and that product by the other; the last product will be the value of the whole.

Note. When the price is very small, proceed as in note to Case IV.

Examples.

1. What is the value of 1500 bushels of wheat, at 7s. 4½d per bushel?

3 times 5 are 15. 7... 4½

10

3 13 9

10

36 17 6

5

184 7 6

3

Ans. £ 553 2 6

2. Required the value of 21000 bushels of salt, at 5s. 6d. per bushel. Ans. £ 5775.

3. What is 2400 quintals of fish worth, at £ 1 4 7½, per quintal? Ans. £ 2955.

4. What is 96000 barrels of beef worth, at £ 2 8 4½, per barrel? Ans. £ 232200.

Case VIII. When the given quantity is a number of hundreds, or of thousands, not expressed in the multiplication table.

Rule. Find the value as near as you can, by Case VII; then find the value of the odd hundreds, or odd thousands, which were not expressed in the table, and add it to, or subtract it from the other, as the case may require.

Note. When the price is very small, proceed as in note to Case IV.

Examples.

1. What is the value of 1900 yards of linen, at 5s. 8½d. per yard?

		5	$8\frac{1}{2}$	
			10	
	2	17	1	
			10	
value of 100,	28	10	10	
			6	
	171	5	0	
			3	
value of 1800, =	513	15	0	
value of 100,	28	10	10	
value of 1900, £	542	5	10	

2. Required the value of 26000 gallons of rum, at 4s. $9\frac{1}{4}$d. per gallon. Ans. £ 6202 1 8.

3. 9300 lb. of coffee at 2s. 4d. Ans. £ 1085.

4. What is the value of 2300 barrels of tar, at 18s. 3d. per barrel? Ans. £ 2098 15.

CASE IX. When the given quantity consists of units, tens, hundreds, thousands, &c.

RULE. Find the value of the thousands, hundreds, &c. separately, and add them together; their sum will be the whole value.

NOTE. When the price is very small, proceed as in note to Case IV.

EXAMPLES.

1. Required the value of 7376 gallons of brandy, at 6s. $9\frac{1}{2}$ per gallon.

		6	$9\frac{1}{2}$	(6
			10	
value of 10.	3	7	11	(7
			10	
value of 100.	33	19	2	(3
			10	
value of 1000.	339	11	8	
			7	
value of 7000=	2379	1	8	
value of 300 =	101	17	6	
value of 70 =	23	15	5	
value of 6	2	0	9	
Ans. £	2506	15	4	

2. 36435 acres of land, at 3s. 9d. per acre.
Ans. £ 6840 18 9.
3. 5673 yards of stuff, at 3s. 7d. per yd.
Ans. £ 1016 8 3.
4. 96487 lb. of coffee, at 1s. 11½d. per lb.
Ans. £ 9447 13 8½.

CASE X. When the given quantity is hundreds Avoirdupois Weight, of 112 pounds each, and the price of one pound given, to find the value of the whole.

RULE. Multiply the price of one by 7, that product by 4, this second product will be the value of a quarter of a hundred; then multiply this second product by 4, gives the value of 1 cwt. which multiply by the number of hundreds, the product will be the value of the whole.

EXAMPLES.

1. Required the value of 9 cwt. of tea, at 7s. 3d. per lb.

		7	3
			7
	2	10	9
			4
value of 1 qr.	£ 10	3	0
			4
value of 1 cwt.	40	12	0
			9
Ans.	£ 365	8	0

2. 11 cwt. at 3s. 9d. per lb. Ans. £ 231.
3. 5 cwt. of sugar, at 10½d. per lb. Ans. £ 24 10.
4. 7 cwt. of tobacco, at 9d. per lb. Ans. £ 29 8.
5. 8 cwt. of butter, at 11d. per lb. Ans. £ 41 1 4.

NOTE. It may perhaps be expected, that rules should be here given for finding the value, when the given quantity is hundreds, quarters, and pounds; and the price per cwt. given; but this will be found in Case X, of Practice; to which the learner is referred for the rule and examples.

Of Weights and Measures.

When several articles of equal weight, or measure, are given, to find the weight or measure of the whole.

Rule. Multiply the weight, or measure of one, by the given number, as in the foregoing cases, the price of one was multiplied, the product will be the weight or measure of the whole.

Examples.

1. Required the weight of 7 hogsheads of tobacco, each weighing 5 C. 2 qrs. 16 lb.

5 2 16
7

Ans. 39C. 2qr. 0

2. 11 chests of tea, each 73lb. 9oz.

73 9
11

Ans. 809lb. 3oz.

3. What is the whole weight of 12 silver spoons, each weighing 2 oz. 15 dwt. 11 gr. ?

Ans. 2 lb. 9oz. 5dwt. 12gr.

4. How many yards of linen in 36 pieces, each 25 yds. 3 qrs. ? Ans. 927 yds.

5. How many bushels of wheat, in 135 bags, each 2 bu. 3 pe. ? Ans. 371 bu. 1 pe.

6. In 75 lots of land, each 123 acres, 2 roods, 15 poles, how many acres, &c. ?

Ans. 9269 acres, 2 roods, 5 poles.

7. If 25 hogsheads of wine are found to contain on an average, 61 gallons, 1 qt. 1 pt. how much is the whole ?

Ans. 1534 ga. 1 qt. 1 pt.

8. If 9 men are employed 21 days, and 6 hours each, how much time has the employer to pay for, among the 9 men, admitting 11 hours are called a day.

Ans. 193 days, 10 hours.

9. There are 11 ships situated as follows, viz. the first ship is in longitude 5° 25′ 33″ west ; the difference of longitude between each, is equal to the longitude of the first ; what is the longitude of the eleventh ship. Ans. 59° 41′ 3″ west.

Supplement to Compound Multiplication.

Case I. When the given quantity is a fraction, and the price or weight, &c. of one given, to find the value of the fractional quantity.

Rule. Multiply the price or weight, &c. of one, by the numerator of the fraction, divide the product by the denominator; the quotient will be the value of the fractional quantity.

Note. If the numerator is 1, then only divide by the denominator.

Examples.*

1. Required the value of $\frac{7}{8}$ of a ship, valued at £ 3576.

3576
7

8)25032

Ans. £ 3129

2. What is the value of $\frac{3}{7}$ of a tun of wine, at £ 36 per tun? Ans. £ 15 8 $6\frac{6}{7}$.

3. What is $\frac{3}{4}$ of a ton of hay worth, at £ 5 10 6 per ton? Ans. £ 4 2 $10\frac{1}{2}$.

4. How much is $\frac{5}{8}$ of a mile? Ans. 5 furlongs.

5. How much is $\frac{7}{10}$ of 1 C. 3 qr. 16 lb.?
Ans. 1 C. 1 qr. $8\frac{4}{10}$ lb.

Case II. When the given quantity is a mixed number.

Rule. Proceed with the fractional part of the quantity, as in the last case. Then multiply the price, weight, or measure of one, by the integral part of the quantity; add this product, and the quotient together; their sum will be the value required.

Note. If the numerator of the fraction is 1, only, divide by its denominator.

* To prove this rule multiply the answer by the denominator, and divide the product by the numerator, the quotient will be the first sum given.

EXAMPLES.

1. Required the value of $7\frac{4}{5}$ gallons of wine, at 5s. $11\frac{1}{2}$d. per gallon.

$$\begin{array}{r} 5\ 11\frac{1}{2} \\ 7\frac{4}{5} \\ \hline 4)1\ 3\ 10 \\ \hline \text{value of } \frac{4}{5} = 0\ 4\ 9\frac{1}{5} = \frac{2}{10} \\ \text{value of } 7 = 2\ 1\ 8\frac{1}{2} = \frac{5}{10} \\ \hline \text{Ans. } £\ 2\ 6\ 5\frac{7}{10} \end{array}$$

2. What is $25\frac{1}{4}$ bushels of salt worth, at 5s. 9d. per bushel?

$$\begin{array}{rr} & \text{s. d.} \\ 4)5\ 9 & 5\ 9 \\ \frac{1}{4} & 5 \\ \hline 1\ 5\frac{1}{4} & 1\ 8\ 9 \\ & 5 \\ \hline \text{value of } 25 = 7\ 3\ 9 & \\ \text{value of } \frac{1}{4} = 1\ 5\frac{1}{4} & \\ \hline \text{Ans. } £\ 7\ 5\ 2\frac{1}{4} & \end{array}$$

3. What is the value of $39\frac{3}{8}$ chaldrons of coals, at £1 18 9 per chaldron? Ans. £76, 5 $9\frac{3}{8}$.

4. There are 8 men, who agree to furnish the following lots of wood, for the parish priest, viz. seven of them will give each 3 cords, the eighth $\frac{7}{8}$ of 3 cords, how much did they all give? Ans. $23\frac{7}{8}$ cords.

DIVISION OF FEDERAL MONEY

Teaches how, from the value of several articles given in Federal money, to find the value or price of one.

RULE. Consider the given value in its lowest denomination; and divide it by the quantity given, as in Simple Division; the quotient will be the value or price of one, in the same denomination, and may be reduced to its proper terms, as before taught.

EXAMPLES.

1. If 7 acres of land cost $ 72, 52, what is it per acre?

7)72,52

$ 10,36 Ans.

2. If 26 yards of linen cost $ 31,79,8, what is it per yard?

26)31,79,8($ 1,22,3 Ans.

26

57
52

59
52

78
78

3. If 37 yards of cloth cost $ 212,75, what is it per yard? Ans. $ 5,75.

4. If 4 of dozen buttons cost $ 2,21,2, what were they per dozen? Ans. $ 0,55,3.

5. If 90 gallons of brandy cost $ 96,75, what was it per gallon? Ans. $ 1,07,5.

6. If 536 quintals of fish cost $ 1913,52, how much per quintal? Ans. $ 3,57.

7. If 26 hogsheads of lime cost $ 94,90, how much per hogshead? Ans. $ 3,65.

8. If 84 pounds of tea cost $ 114,24, how much per lb.? Ans. $ 1,36.

9. If 3 hogsheads of tobacco, each weighing net 5C. 2qr. 17 lb. cost $ 114,44,5, what was it per lb.?
Ans. $5\frac{1}{2}$ cents.

10. If 15 hogsheads of sugar, each weighing net 12 C. 1 qr. 16 lb. cost $ 1041, how much was it per lb?
Ans. 5 cents.

11. If 35 tons of hay cost $ 525, how much was it per cwt.? Ans. 75 cents.

12. If 57 yards of stuff cost $ 21,09, what was it a yard? Ans. 37 cents.

13. If 9 lb. of coffee cost $ 2,97, how much was it per lb.? Ans. 33 cents.

14. If 5 barrels of sugar, containing each 2 C. 1 qr. 15 lb. net, cost $ 93,45, how much a pound? Ans. 7 cts.

15. If 25 bushels of wheat cost $ 28,12$\frac{1}{2}$, what is it a bushel? Ans. $ 1,12$\frac{1}{2}$.

Any articles bought or sold by the thousand, as boards, plank, bricks, &c. the value of several thousands, hundreds, &c. given, to find the value, or price of one thousand.

Rule. To the whole value given, annex three ciphers, then divide it by the given quantity, the quotient will be the price of one thousand, in the lowest denomination of the given value, which may be reduced as above.

Examples.

1. If 25374 feet of boards cost $ 190,29,5, how much is it per thousand?

25374)$190,29,5000($7,50,0 Ans.
177 60 8

12 68 70
12 68 70

00

2. If 46487 feet of boards cost $ 314,02, how much per thousand? Ans. $ 6,75,5+

3. If 22736 bricks cost $126,18,5 how much per thousand? Ans. $ 5,55+

4. If 237385 bricks cost $ 1483,65,6¼, how much per thousand? Ans. $ 6,25.

When the given quantity is a fraction, and the price of one required.

Rule. Multiply the given value by the denominator of the fraction, and divide the product by the numerator, the quotient will be the price of one.

Examples.

1. If ¾ of a yard of cloth cost $ 3,18,7½, how much is it per yard?

3,18,7,5
3
4

3)12 75 00

dols. 4,25 Ans.

Note. These questions may be proved by multiplication of Federal Money, by fractions.

2. If ⅛* of a ton of timber cost 43 cents, 7½ mills, how much per ton? Ans. $3,50.*

3. If ⅞ of a ton of hay cost $ 16,24, what is it per ton? Ans. $18,56.

4. If ⅛ of an acre of land cost $ 1,96,2, what is it per acre? Ans. $17,65,8.

When the given quantity is a mixed number, and the value of one required.

* When the numerator is 1, division is unnecessary, therefore, only multiply by the denominator, the product will be the answer.

RULE. Multiply the integer of the given quantity, by the denominator of the fraction; to the product add its numerator, for a divisor.

Multiply the given value by the same denominator, for a dividend.

Divide this new dividend, by the new divisor, the quotient will be the answer.

EXAMPLES.

1. If $26\frac{3}{4}$ bushels of wheat cost dolls. 33,43,7½, how much per bushel?

33,43,7,5
4

$26\frac{3}{4}$ | 107)133,75,00($1,25 Ans.
107
267
214
535
535

NOTE. These questions may be proved by multiplication of Federal Money, by mixed numbers.

2. If $375\frac{1}{2}$ bushels of salt cost dolls. 281,62,5, how much per bushel? Ans. 75 cents.

3. If $9\frac{7}{8}$ yards of cloth cost dolls. 44,43,7½, how much per yard? Ans. dolls. 4,50.

Questions for exercise in Division of Federal Money.

1. If 4 dozen of buttons cost dolls. 2,21,2, how much per dozen? Ans. 55 cents, 3 mills.

2. If 90 gallons of brandy cost dolls. 96,75, how much per gallon? Ans. dolls. 1,07,5.

3. If 536 quintals of fish cost dolls. 1913,52, how much per quintal? Ans. dolls. 3,57.

4. If 46 hogsheads of lime cost dolls. 167,90, how much per hogshead? Ans. dolls. 3,65.

5. If 84 lb. of tea cost dolls. 114,24, how much per lb.? Ans. dolls. 1,36.

6. If 3 hogsheads of tobacco, each weighing net 5 C. 2 qrs. 17 lb. cost dolls. 104,44,5, how much per lb ?
Ans. $5\frac{1}{2}$ cents.

7. If 15 hogsheads of sugar, each weighing net 12 C. 1 qr. 16 lb. cost dolls. 3123, how much per lb ?
Ans. 15 cents.

8. If 35 tons of hay cost dolls. 525, how much is it per cwt. ? Ans. 75 cents.

9. If 57 yards of stuff cost dolls. 21,09, how much per yard ? Ans. 37 cents.

10. If 9 pounds of coffee cost dolls. 2, 97, what is it per lb ? Ans. 33 cents.

11. If 5 barrels of sugar, each weighing net 2 C. 1 qr. 15 lb. cost dolls. 93,45, how much per lb ?
Ans. 7 cents.

12. If 12 C. 3 qrs. of sugar cost dolls. 133,87,5, how much per cwt ? Ans. dolls. 10,50.

13. If $9\frac{1}{2}$ C. of iron cost dolls. 40,37,5, how much per cwt. ? Ans. dolls. 4,25.

14. If $5\frac{7}{8}$ yards of cloth cost dolls. 22,03,$1\frac{2}{8}$, how much per yard ? Ans. dolls. 3,75.

15. If $95\frac{3}{4}$ acres of land cost dolls. 704,72, how much per acre ? Ans. dolls. 7,36.

16. If $11\frac{4}{10}$ tons of hay cost dolls. 209,76, how much per ton ? Ans. dolls. 18,40.

17. If $46\frac{7}{8}$ bushels of salt cost dolls. 22,03,$1\frac{1}{4}$, how much per bushel ? Ans. 47 cents.

18. Delivered to a purchaser, at sundry times, the following quantities of wheat, viz. $46\frac{3}{4}$ bushels, $72\frac{1}{2}$, $69\frac{1}{4}$, $56\frac{1}{2}$, $73\frac{1}{4}$ bushels, and received for the whole dolls. 389,43,$7\frac{1}{2}$; how much was it per bushel ?
Ans. dolls. 1,25.

Compound Division

Teaches to divide a number of diverse denominations, by a simple number, a fraction, or a mixed number, and is applied to find the value of one, by having the value of a certain number given ; also, to find the weight, measure, &c. of one, by having the weight, or measure of a certain number given.

Of Money.

CASE I. When the given quantity does not exceed 12. Integers, or whole numbers.

RULE. Divide the highest denomination as in Simple Short Division, setting its quotient under it; if any remain, reduce it to the next lower denomination, and add it to the number (if any) which stands in the next lower; divide this sum, setting the quotient under this denomination, &c. through all the denominations.

Compound Division, and Compound Multiplication, prove each other.

EXAMPLES.

1. If 3 gallons of rum cost 17s. 3d. what is it per gallon?

3)17 3

Ans. 5s. 9d.

2. If 7 yards of cloth cost £ 8 5 4½, how much was it per yard? Ans. £ 1 3 7½.

3. If 9 lb. of tea cost £ 3 5 5¼. how much per lb? Ans. 7s. 3¼d.

4. If 11 barrels of tar cost £ 8 14 7¾ what was it per barrel? Ans 15s. 7¼d.

5. If 12 hogsheads of rum cost £ 279 12 6. how much per hogshead? Ans. £ 23. 6 0½.

6. If 11 yards of tape cost 1s. 4½d. what was it per yard? Ans. 1½d.

7. If 10 gallons of brandy cost £ 2 19 9½, how much per gallon? Ans. 5s. 11¾d.

8. Bought 8 barrels of flour for £ 15 16 4, how much was it per barrel? Ans. £ 1 19 6½.

CASE II. When the given quantity exceeds 12, and can be found in the multiplication table.

RULE. Take the two numbers which produce it, divide by one of them; then divide this quotient by the other, the second quotient will be the answer.

NOTE. If there be remainders in one, or in both operations, proceed as directed in Case III. of Simple Long Division, to find the true remainder.

EXAMPLES.

1. If 35 bushels of wheat cost £ 12 14 5¼, how much was it per bushel?

5 times 7 are 35.

5)12 14 5¼

7)2 10 10¼

Ans. 7s. 3¼d.

2. If 108 acres of land cost £ 1789 1 9, what was it per acre? Ans. £ 16 11 3¾.

3. If 84 gallons of brandy cost £ 23 12 6, how much per gallon? Ans. 5s. 7½d.

4. If 144 pounds of cheese cost £ 5 8, how much per pound.? Ans. 9d.

5. If 70 bushels of wheat cost £ 25 8 11½, how much per bushel? Ans. 7s. 3½d.

6. If 132 bushels of salt cost £ 31 7, how much per bushel? Ans. 4s. 9d.

7. If 64 gallons of brandy cost £ 16 13 4, how much per gallon? Ans. 5s. 2½d.

CASE III. When the given quantity exceeds 12, and cannot be found in the multiplication table.

RULE. Proceed as in Simple Long Division, divide the highest denomination, setting the quotient at the right of the lowest. If any remain, or if the divisor is not contained in the highest denomination, reduce it to the next lower, adding the number (if any) standing in the next; divide this sum as the other, and thus proceed through all the denominations.

EXAMPLES.

1. If 26 yards of silk cost £ 12 8 1, how much per yd?

26)12 8 1(0 9s. 6½. Ans.

20

248

234

14

12

169

156

13

4

52

52

2. If 46 barrels of flour cost £65 12 11, what was it per barrel? Ans. £1 8 6½.

3. If 76 yards of linen cost £17 19 5, how much per yard? Ans. 4s. 8¼d.

CASE IV. When the given quantity is any number of hundreds less than 13, as 700, 1100, &c.

RULE. Divide the value of the whole quantity, by the number of hundreds, the quotient will be the value of 100; then divide this quotient by 10, and the second quotient by 10, the third quotient will be the price of one.

EXAMPLES.

1. If 700 lb. of coffee cost £56 2 11, how much per lb?

7)56 2 11

10)8 0 6

10)0 16 0⅛

Ans. £0 1s. 7⅛d.

2. If 1200 lb. of chocolate cost £137 10, how much per lb? Ans. 2s. 3½d

3. If I give 396 9 2, for 1100lb of tea, what was it per lb? Ans. 7s. 2½d.

4. 800 lb. of sugar cost me £25, what did I give per lb? Ans. 7½d.

CASE V. When the given quantity is any number of thousands less than 13, as 11000, 12000, &c.

RULE. Divide the whole value by the number of thousands, then divide this first quotient by 10, the second by 10, and the third by 10, the fourth quotient will be the price of one.

EXAMPLES.

Sold 9000 quintals of fish, for £5737 10, what had I per quintal?

9)5737 10

10)637 10

10)63 15

10)6 7 6

Ans. £0 12 9.

2. If 12000 lb. of coffee cost £1075, how much per lb.? Ans. 1s. 9½d.

3. If 7000 gallons of wine cost £1961 9 2, how much per gallon? Ans. 5s. 7¼d.

4. Sold 11000 bushels of wheat for £3066 13 4, how much per bushel? Ans 6s. 8d.

Case VI. When the given quantity is any number of hundreds, or of thousands over 12, which are expressed in the multiplication table.

Rule. Find the two numbers which produce the number of hundreds, or of thousands; divide the whole value by one of those numbers, and that quotient by the other, the second quotient will be the value of one hundred, or of one thousand, as the case may be; then, if the given quantity is hundreds, divide by 10 twice, as in Case IV; but if thousands divide by 10, three times, as in Case V, to obtain the price of one.

Examples.

1. If 1500 bushels of wheat cost £553 2 6, how much per bushel?

5)553 2 6

3 times 3 are 15.

3)110 12 6

10)36 17 6

10)3 13 9

Ans. £0 7 4½

2. If 21000 bushels of salt cost £5775, what per bushel? Ans. 5s. 6d.

3. If 2400 quintals of fish cost £2955, what per quintal? Ans. £1 4 7½.

4. 96000 barrels of beef cost £ 232200, how much per barrel? Ans. £ 2 8 4¼.

CASE VII. When the given quantity is hundreds Avoirdupois Weight, and the price of one pound required.

RULE. Divide the whole value by the number of hundreds, the quotient will be the value of one hundred weight; then divide this quotient by 4, the next by 4, and the third quotient by 7, the fourth quotient will be the price of one.

EXAMPLES.

1. If 9 cwt. of tea cost £ 365, 8, how much is it per lb?

9)365 8

4)40 12

4)10 3

7)2 10 9

Ans. 7s. 3d.

2. If 5 cwt. of tobacco cost £ 24 10, how much per lb? Ans. 10½d.

3. If 7 cwt. of sugar cost £ 29 8, how much per lb? Ans. 9d.

4. If 8 cwt. of butter cost £ 41 1 4, how much per lb? Ans. 11d.

Of Weights, Measures, &c.

When the whole weight or measure of several articles are given, which are each of equal weight, or measure, to find the weight or measure of one.

RULE. Divide the whole weight or measure, by the given number of articles agreeable to the foregoing cases, the result will be the weight or measure of one.

EXAMPLES.

1. There were 7 hogsheads of tobacco of equal weight, the whole weighed 39 C. 2qrs. required the weight of each.

7)39 2

Ans. 5C. 2qr. 16lb.

2. The whole weight of 11 chests of tea was 809lb. 3 oz. their weight was equal; what was the weight of each? Ans. 73lb. 9oz.

3. What was the weight of each silver spoon, when 12 of equal weight, weighed 2 lb. 9 oz. 5 dwt. 12 gr.
Ans. 2 oz. 15 dwt. 11 gr.

4. In 36 pieces of linen, measuring equally, there are 927 yards; how many yards is in each piece?
Ans. 25yds. 3 qrs.

5. There are 135 bags containing equal quantities of wheat, the whole is 371 bu. 1 pe.; how much was in each bag? Ans. 2¾ bushels.

6. In 75 equal lots of land, there are 9269 acres, 2 roods, and 5 perches, how much is in each lot?
Ans. 123 acres, 2 roods, 15 po.

7. In 25 hogsheads of equal contents, there are 1534 galls. 1 qt. 1 pt.; how much is in each hogshead?
Ans. 61 ga. 1 qt. 1 pt.

8. A man employed nine labourers so long, that all their time added together, amounted to 193 days, and 6 hours, allowing 11 hours to a day, how long did they work? Ans. 21 days, and 6 hours.

9. The whole circumference of the heavenly space, (called the zodiac) is divided by astronomers into twelve equal parts, called signs; how many degrees are in one sign? Ans. 30.

Supplement to Compound Division.

Case I. When the given quantity is a fraction, and the price, weight or measure of one required.

Rule. Multiply the given value or weight, &c. by the denominator of the fraction, divide the product by the numerator, the quotient will be the price or weight, &c. of one.

Note. When the numerator is one, only multiply by the denominator.

EXAMPLES.

1. Required the value of a ship, $\frac{7}{8}$ of which cost £3129.

3129
8
7)25032
Ans. £ 3576

2. What is the price of a tun of wine, $\frac{3}{7}$ of which cost £ 15 8 $6\frac{6}{7}$. Ans. £ 36.

3. What is hay per ton, when $\frac{1}{4}$ of it cost £ 4 2 $10\frac{1}{2}$.
Ans. £ 5 10 6.

4. $\frac{7}{10}$ of a certain weight, is 1 C. 1 qr. $8\frac{4}{10}$lb. what is the whole? Ans. 1C. 3qrs. 16 lb.

CASE II. When the given quantity is a mixed number, and the value, weight, or measure, of one required.

RULE. Multiply the integer of the given quantity by the denominator of its fractional part; to the product add its numerator, for a divisor. Multiply the given value, weight, or measure, by the same denominator, for a dividend; the quotient of these new numbers will be the answer.

Questions in this rule are proved by a contrary process.

EXAMPLES.

1. What is wine per gal. when $7\frac{8}{10}$ galls. cost £2 6 $5\frac{7}{10}$.

2 6 $5\frac{7}{10}$
$7\frac{8}{10}$ 10
78)23 4 9(£0 5 $11\frac{1}{2}$ Ans.
20
464
390
74
12
897
78
117
78
39
4
156
156

To prove this.
£0 5 $11\frac{1}{2}$
8 (6
2 7 8
9
21 9 0
1 15 9
10)23 4 9
Proof. £2 6 $5\frac{7}{10}$.

{8 times 9 are 72, and 6 are 78.}

2. If $25\frac{1}{4}$ bushels of salt cost £ 7 5 $2\frac{1}{4}$, how much is it per bushel? Ans. 5s. 9d.

3. If $39\frac{3}{8}$ chaldrons of coals cost £ 76 5 $9\frac{3}{8}$, how much per chaldron? Ans. £ 1 18 9.

Questions for exercise in Compound Multiplication and Division, in Federal and other Currencies.

1. If a hound run 400 yards in a minute, for 3 days, running 10 hours, 48 minutes, and 20 seconds each day; how many miles will he run?

Ans. 442 miles, and 80 yards.

2. A merchant bought 400 hogsheads of rum, each contained 116 gallons, 2 quarts, 1 pint, at 75 cents per gallon; what did the whole cost? Ans. $34987,50.

3. A merchant bought 10 bales of broadcloth, each bale contained 12 pieces, each piece 40 yards, for $ 18000; what was it per yard? Ans. $ 3,75.

If for $ 133, I buy cider, at 15 cents per gallon, perry at 20 cents, rum at 60 cents, brandy at 75 cents, Sherry wine at $ 1,20, Lisbon wine at $ 1,50, Madeira wine at $ 2,25 per gallon, and have an equal quantity of each, how many gallons did I buy of each sort? Ans. 20.

5. At an entertainment were there were an equal number of men, women, and children, who were charged as follows, viz. the men $ 2 each, the women, $ 1, and the children 50 cents each, and the whole bill was $ 70; how many of each sort were there? Ans. 20.

6. At $ 3,75 per yard, what is the value of 10 bales of broadcloth, each bale containing 12 pieces, and each piece 40 yards? Ans. $ 18000.

7. In 5 C. 2 qrs. $21\frac{1}{4}$lb. I had 25 parcels of equal weight; what was the weight of each parcel? Ans. $25\frac{1}{2}$lb.

8. I bought cider for 15 cents per gallon, perry for 20 cents, rum for 60 cents, brandy for 75 cents, Sherry wine for $ 1,20, Lisbon wine for $1,50, Madeira wine for $ 2,25 per gallon, and had 20 gallons of each sort; what did the whole cost? Ans. $ 133.

9. Divide $ 180, among A, B, and C, give B twice as much as A, and C three times as much as B.

A has 1 simple share. Simple shares 9)180

×2

B =2 simple shares. $ 20 A's share.

×2

×3 $ 40 B's share.

C =6 simple shares. ×3

9 simple shares, total. $120 C's share.

Proof. $180 sum of shares.

10. Divide $3515 among A, B, C, and D, give B three times as much as A, C four times as much as B, and D five times as much as C.

Answer. $ 46, 25 A's, 138, 75 B's, 555, C's, 2775, D's, } share.

11. Divide $ 7576 among A, B, C, and D, give B three times as much as A, C five times as much as B, and D ten times as much as all the others.

Ans. $ 36, 25 A's, 108, 75 B's, 543, 75 C's, 6887, 50 D's, } share.

12. A man left his estate by will as follows, viz. his widow to have one third, the remainder to be divided among seven children equally, excepting that the eldest should have a double share; the whole estate was valued at £ 4278 6; what was each share?

The widow's share £ 1426 2
The eldest child 713 1
The others each 356 10 6 } Answer.

13. If 39⅜ chaldrons of coals cost £ 76 5 9⅜, how much was it per chaldron? Ans. £ 1 18 9.

14. If 25 hogsheads of tobacco cost £ 469 10 7½, and each hogshead weighed 5 C. 1 qr. 13 lb. net, what was it per lb? Ans. 7¼d.

15. Required the value of 27 hogsheads of rum, containing 108 gallons each, at 75 cents per gallon?

Ans. $ 2202.

16. If 27 hogsheads of rum, containing 108 gallons each, cost $ 2202, how much was it per gallon?

Ans. 75 cts.

17. A man left his estate amounting to £ 7000 by will, as follows, viz.

His wife being pregnant. If the child should be a son, he was to have two thirds, and the mother one. If a daughter, she was to have one third, and the mother two.

She was delivered of a son, and a daughter; how much must each have, agreeably to the will.

Answer. { The widow, £ 2000. / The son, 4000. / The daughter, 1000.

18. There were 56 men who paid 16s. 3d. each, at an entertainment, how much was the whole bill?

Ans. £ 45 10.

19. Bought 4 hogsheads of rum as follows, viz. No. 1, containing 108 gallons, at 75 cents per gallon; No 2, 111, at 80 cents; No. 3, 114¼, at 96 cents; No. 4, 120¾, at 90 cents per gallon; how much did the whole cost? Ans. $ 388,39,5.

20. At 3½d. per lb. what cost 100 barrels of beef, each weighing net, 200 lb?

Ans. £191 13 4.

21. Bought 2000 quintals of fish, which being damaged, I threw away ⅞ of it, and sold the remainder for 15s. per quintal; what did it come to?

Ans. £ 187 10.

PRACTICE.

Practice is an easy method of finding the whole value of any given number of ounces, pounds, gallons, hogsheads, &c. by having the price of one given.

NOTE: In some cases Multiplication of Federal Money, or Compound Multiplication, will be found preferable to this Rule, but in many, this is to be preferred.

TABLES.

Parts of a penny.	Parts of a shilling.	Parts of a pound.	Parts of a lb.	Parts of an cwt.
$\frac{1}{4}$ is $\frac{1}{3}$	6d. is $\frac{1}{2}$	10s. is $\frac{1}{2}$	1, 4 is $\frac{1}{15}$	8oz. is $\frac{1}{2}$	56lb. is $\frac{1}{2}$
$\frac{1}{2}$ is $\frac{1}{6}$	4 " $\frac{1}{3}$	6, 8d. " $\frac{1}{3}$	1, 6 " $\frac{1}{16}$	4 " $\frac{1}{4}$	28 " $\frac{1}{4}$
$\frac{1}{2}$ " $\frac{1}{12}$	3 " $\frac{1}{4}$	5 " $\frac{1}{4}$	1 " $\frac{1}{20}$	2 " $\frac{1}{8}$	16 " $\frac{1}{8}$
	2 " $\frac{1}{6}$	4 " $\frac{1}{5}$	0, 8 " $\frac{1}{30}$	1 " $\frac{1}{16}$	14 " $\frac{1}{8}$
	$1\frac{1}{2}$ " $\frac{1}{8}$	3, 4 " $\frac{1}{6}$	0, 6 " $\frac{1}{40}$		8 " $\frac{1}{14}$
	1 " $\frac{1}{12}$	2, 6 " $\frac{1}{8}$	0, 4 " $\frac{1}{60}$		7 " $\frac{1}{16}$
		2 " $\frac{1}{10}$	0, 3 " $\frac{1}{80}$		
		1, 8 " $\frac{1}{12}$	0, 2 " $\frac{1}{120}$		

Case I.

When the given price is less than a penny, divide the given number of articles by the aliquot parts of a penny, and then divide that quotient by 12, and the next quotient by 20, for pounds, &c.

Examples.

What is the value of 7648 of any article, at ¼d. each ?

¼	¼	7648	¼
	12	1912	
	2|0	15|9 4	
		£ 7 19 4 Ans.	

½	½	9647 at ½d.	½
	12	4823½	
	2|0	40|1 11	
		£ 20 1 11½ Ans.	

¾	½	6482 at ¾d.*	½
¼	½	3241	¼
		1620½	
	12	4861	
	2|0	40|5 1	
		£ 20 5 1½ Ans.	

* As 3 farthings are ¾ of a penny, it is easiest to take ½ first, and then the ¼ left is ½ of that ½, which being taken, and the two lines added together, gives the whole value in pence.

¼	¼	9364 at ¼d.	¼
	12	2341	
	2|0	19|5 1	
		£ 9 15 1 Ans.	

½	½	7364 at ½d.	½
	12	3682	
	2|0	30|7 10	
		£ 15 7 10 Ans.	

½	½	9563 at ¾d.	½
	½	4781½	
		2390¾	
	12	7172¼	
	2|0	59|7 8¼	
		£ 29 17 8¼ Ans.	

	5964 at ¼d.
	£ 6 0 1 Ans.

	7368 at ½d.
	£ 15 7 Ans.

	9785 at ¾d.
	£ 30 11 6¾ Ans.

CASE II. When the given price is an aliquot part of a shilling, divide the given number by the aliquot part, and the quotient will be the value in shillings, which must be reduced to pounds.

If the given price is not an aliquot part of a shilling, divide by some aliquot part, then take parts of that aliquot part, &c.

1d.	$\frac{1}{12}$	5963 at 1d.	6
	2|0	49|6 11	2
			$\frac{1}{2}$
		£ 24 16 11 Ans.	

1264 at 1d.
Ans. £ 5 5 4.

6932 at 1d.
Ans. £ 28 17 8.

1d.	$\frac{1}{12}$	2364 at $1\frac{1}{4}$d.	
$\frac{1}{4}$	$\frac{1}{4}$	197	
		49 3	
	2|0	24|6 3	
		£ 12 6 3 Ans.	

9736 at $6\frac{1}{4}$d.
A. £ 253 10 10.

5296 at $9\frac{1}{4}$.*
Ans. £ 204 2 4.

* *I first say, 6d. is $\frac{1}{2}$ a shilling and 3d. that remained is half the 6d. the remaining farthing is $\frac{1}{12}$ of the 3d. &c.*

$\frac{1}{2}$	1296 at $8\frac{1}{2}$d.	
$\frac{1}{3}$	648	
$\frac{1}{4}$	216	
	54	
2|0	91|8	
	£ 45 18 Ans.	

Here I say 6d. is half a shilling. and 2d. $\frac{1}{3}$ of 6d. and $\frac{1}{2}$ is $\frac{1}{4}$ of 2d.

5684 at $5\frac{1}{2}$d.
Ans. £ 130 5 2.

9630 at $11\frac{1}{2}$d.
Ans. £ 461 8 9.

7364 at $4\frac{1}{2}$d.
Ans. £ 138 1 6.

9360 at $2\frac{1}{2}$d.
Ans. 97 10.

7360 at $1\frac{1}{2}$d.
Ans. £ 46.

9630 at $5\frac{1}{2}$d.
Ans. £ 220 13 9.

9364 at $8\frac{1}{2}$d.
Ans. £ 429 3 8.

6d. ½	7364 at 7½d.	1136 at 7¼
		Ans. £ 36 13 8.
1½ ¼	3682	4370 at 11¾.
	920 6	A £ 213 18 11½
2|0	460|2 6	5762 at 8¼d.
	£ 230 2 6 Ans.	Ans. £ 210 1 5½
	4875 at 3½d.	4369 at 4¼d.
	Ans. £ 71 1 10½	Ans. £ 86 9 4¼.
	7365 at 9½d.	5364 at 10½d.
	A. £ 298 16 5½.	A. £ 234 13 6.
6 ½	7396 at 9¼d.	4360 at 5¼d.
		A. £ 104 9 2.
3 ½	3698	7364 at 3¾d.
¾ ¼	1849	A. £ 115 1 3.
	462 3	4936 at 1¾d.
2|0	600|9 3	A. £ 35 19 10.
	£ 300 9 3 Ans.	5936 at 2½d.
	5936 at 6¾d.	A. £ 61 16 8.
	Ans. £ 166 19	

Case III. When the given price is more than one shilling, and less than two.

Take parts with the excess over a shilling, and add to the quantity given, the whole will be shillings, &c. which must be reduced to pounds.

6d. ½	5963 at 18¼d.	*Note. The two first and the fourth lines are added together, because the fourth is a twenty fourth part of the second, which is found by dividing the second by 6, and that quotient by 4.*	
¼ 1/24	6)2981 6 val. at 6d.		
	4)496 11 not add.		
	124 2¾ val. at ¼		
2|0	900|8 8¾		
	£453 08 8¾ Ans.	7364 at 23½d.	
		£721 1 2 Ans.	

4d.	$\frac{1}{3}$	9376 at $17\frac{1}{4}$d.	$\frac{1}{2}$	$\frac{1}{2}$	486 at $12\frac{1}{2}$d.
$1\frac{1}{2}$.	$\frac{1}{8}$	3125 4 val. at 4d.			
$\frac{1}{4}$d.	$\frac{1}{6}$	1172 at $1\frac{1}{2}$d.		12	243
		195 4 at $\frac{1}{4}$d.			
					20 3 val. at $\frac{1}{2}$d
	2|0	1386|8 8		2|0	50|6 3
		£693 8 8 Ans.			£25 6 3 Ans.
		9328 at $15\frac{1}{4}$d.			
		£592 14 4 Ans.			

Case IV. When the given price is shillings only.

1. If the given price be an even number of shillings, multiply the quantity by half the number of shillings, and double the first figure of the product for shillings, the others will be pounds.

Note. If the first figure in the product, when doubled, exceed 20, *or* 40, 60, *&c ; set down the excess over twenties, for shillings, and carry one for each twenty, to the product of the second figure, for pounds ; or if they are an aliquot part of a pound, divide by that part.*

2. If the given price be an odd number of shillings, as 1, 3, 5, 7, &c. multiply the quantity by half the greatest even number of shillings, as above directed, and to the product add $\frac{1}{20}$ of the given quantity, their sum will be pounds, &c. Or multiply the quantity by the shillings, gives shillings.

5687 at 8s.
4 half the shillings.

£ 2274 16 Ans.

2|0 7364 at 9s.
4 is $\frac{1}{2}$ greatest even number.

2945 12
368 4 a twentieth part.

£ 3313 16 Ans.

5964 at 16s.
£ 4771 4 Ans.

7364 at 13s.
£ 4786 12 Ans.

9304 at 12s.
£ 5618 8 Ans.

7936 at 5s.
£ 1984 Ans.

7391 at 18s.
£ 6651 18 Ans.

4368 at 19s.
£ 4149 12 Ans.

4738 at 7s.
£ 1658 6 Ans.

CASE V. When the given price is shillings and pence, and are an aliquot part of a pound.

Dividing the quantity by that aliquot part, gives the answer in pounds, &c.

2s.6d. | 1/8 | 5684 at 2s. 6d.
£710 10 Ans.

6s. 8d | 1/3 | 5978 at 6s. 8d.
£1992 13 4 Ans.

3s. 4d | 1/6 | 4378 at 3s. 4d.
£729 13 4 Ans.

5963 at 6s. 8d.
£1987 13 4 Ans.

4372 at 2s. 6d.
£546 10 Ans.

7364 at 3s. 4d.
£1227 6 8 Ans.

When the shillings and pence are not an aliquot part of a pound, or if there be shillings, pence, and farthings in the given price.

Multiply the quantity by the shillings, and take parts for the pence and farthings; then add the product, and these parts together, for shillings, &c.

3d. | 1/4 | 5963 at 9s. 3d.
9
53607
1490 9
2|0 | 5515|7 9
£2757 17 9 Ans.

4d. | 1/3 | 5936 at 19s. 4 3/4 d
19
53424
5936
1/5 | 1/8 | 1978 8
1/20 | 1/2 | 247 4
123 8
2|0 | 11513|3 8
£5756 13 8 Ans.

6d.	½	4362 at 11s.8½d
		11
		47982
2d.	⅓	2181
½	¼	727
		181 9
	2|0	5107|1 9
		£2553 11 9 Ans.

1296 at 7s. 4½d.
£477 18 Ans.

5937 at 11s. 9¼d.
£3506 10 9¼ Ans.

Case VI. When the given price is pounds only.

Multiply the quantity by the price, the product will be the answer in pounds.

735 at £ 7.
7
£5145 Ans.

436 at £4.
£1744 Ans.

843 at £19.
£16017 Ans.

736 at £27
£19872 Ans.

Case VII. When the given price is pounds and shillings.

Multiply the quantity by the pounds, then proceed with the shillings as in Case IV.

5s.	¼	563 at £ 5 9.
4s.	⅕	5
		2815
		140 15
		112 12
		£3068 7 Ans.
		5763 at £9 11.
		£ 55036 13 Ans.

10s.	½	596 at £ 7 10.
		7
		4172
		298
		£4470 Ans.
		464 at £15 7.
		£ 7122 8 Ans.
		573 at £3 19.
		£ 2263 7.

Case VIII. When the given price is pounds, shillings, and pence, &c.

1. If the shillings and pence, &c. are an aliquot part of a pound, then multiply the given quantity by the pounds, and also divide it by the aliquot part of a pound, the shillings, &c. make; then add the product and quotient together, their sum will be the answer in pounds, &c.

3|4	$\frac{1}{5}$	536 at £ 3 3 4.	576 at £ 1 6 8.
		3	£768 Ans.
		1608	736 at £11 13 4.
		89 6 8.	£8586 13 4 Ans.
		£1697 6 8 Ans.	436 at £7 10.
		374 at £ 2 2 6.	£3270 Ans.
		£794 15 Ans.	

2. If the shillings and pence in the given price are not an aliquot part of a pound, or if there are farthings given in the price, with the pounds, shillings, and pence.

Reduce the pounds and shillings to shillings, and multiply the given quantity by those shillings; then take parts with the pence, &c. and add the product and quotient, or quotients together, their sum will be shillings, &c. which must be reduced to pounds; or proceed as below directed.*

3d.	$\frac{1}{4}$	596 at £4 7 $3\frac{1}{2}$.	493 at £ 6 14 $5\frac{1}{2}$
		97 $\frac{20}{97}$	£3314 7 $11\frac{1}{2}$ Ans.
		4172	735 at £1 14 7.
		5364	£1270 18 9 Ans.
$\frac{1}{2}$	$\frac{1}{6}$	149	
		24 10	116 at £ 3 18 $8\frac{3}{4}$.
			£456 12 7 Ans.
	2|0	5798|5 10	73 at £ 2 11 $3\frac{1}{4}$.
		£2899 5 10 Ans.	£ 114 8 $9\frac{1}{4}$ Ans.

* 1. If the given quantity does not exceed 12, multiply the price by the quantity, as in Compound Multiplication, Case I.
2. If the quantity exceeds 12, proceed as in Compound Multiplication, Cases II, to IX, as the case may require.

562 at £ 2 10 6.
£1419 1 Ans.

375 at £5 14 7¼.
£2148 16 6¾ Ans.

CASE XI. When the given quantity is any number of hundreds Avoirdupois Weight, of 112 pounds, and the price of 1 pound given.

Proceed as in Compound Multiplication, Case X. to which the learner is referred for examples, and the rule.

CASE X. When both the price and the quantity are of several denominations.

Multiply the price by the integers in the quantity, and then take parts with the parts of integers, in the quantity, and add the product and quotients together, their sum will be the answer.

12C. 3qrs. 16lb. of tobacco, at £ 4 12 per C.

2qrs. ½	4 12	
	12	
	55 4	
1qr. ½	2 6	
14lb. ½	1 3	
2lb. ⅛	0 11 6	
	0 1 7¼ 6/7	

Ans. £59 6 1¼ 6/7.

Questions. C. qr. lb.		Answers.	
12 2 14 of tobacco at	£3 14 0 per C.	£46 14 3	
17 3 19 of sugar, at	2 2 6 per C.	38 1 6¾	46/112
4 1 16 of soap, at	3 12 0 per C.	15 16 3¼	6/7
10 0 12 of tallow, at	1 19 6 per C.	19 19 2¾	¼
5 1 0 of tobacco, at	2 17 0 per C.	14 19 3	
7 0 19 of sugar, at	3 16 0 per C.	27 4 10½	6/7
5 2 10 of tobacco, at	2 18 6½ per C.	16 7 2½	3/8
7 1 14 of tobacco, at	3 15 9¼ per C.	27 18 9½	+
9 2 26 of tallow, at	4 10 4½ per C.	43 16 6	+
4 3 0 of sugar, at	2 18 6 per C.	13 17 10½	

SINGLE RULE OF THREE DIRECT.

The Single Rule of Three Direct is known from Inverse Proportion by more requiring more, or less requiring less, i. e. if the third term be greater than the first, the fourth term or answer must be greater than the second or middle term, and contrarywise, if the third term be less than the first, the fourth must be less than the second or middle term.

The third term must be that which makes the demand, and is known by these and the like expressions; how many, how much, how far, what will, what cost, &c.

The third term being ascertained, the first must be of the same kind or quality; and the middle or second term must be always of the same kind, or quality of the answer.

Having stated the terms as above, if they are of several denominations, reduce the first and third terms to the lowest mentioned in either; also reduce the middle term to the lowest denomination mentioned in it.

Having thus prepared the terms for a solution, multiply the second and third together, and divide the product by the first, the quotient will be the answer in the same denomination the middle term was reduced to.

If any remain, reduce it to the next lower denomination, and divide again by the first term, the quotient of this will be so many of the denomination you last divided, &c.

Questions in this rule are proved by inverting their order.

EXAMPLES.

1. If 6 yards of cloth cost $9, what will 12 yards cost?

yds. $ yds.
6 : 9 :: 12
12

6)108

$18 Ans.

2. If 12 yards of cloth cost $18, what will 6 yards cost?

12 : 18 :: 6
6

12)108

$9 Ans.

3. If 9 dols. will pay for 6 yards of cloth, how many yards for 18 dols.?

9 : 6 :: 18
6

9)108

Ans. 12 yds.

4. If 12 yards of cloth cost $18, how many yards can be bought for 9 dols.?

18 : 12 :: 9
9

18)108(6yds. Ans.
108

Note. These four examples prove each other by inverting or varying their order, as do many of the following.

5. If a hogshead of wine cost $ 31, 50, how much will a quarter cask cost containing 31½ gallons?

63 : 31,50 : : 31 ga. 2 qts.
4 126 4

252 18900 126
37800

252)396900 ($15, 75 Ans.
252

1449
1260

1890
1764

1260
1260

6. If a quarter cask of wine, containing 31½ gallons, cost $15, 75, how much is it per hogshead?

31½ : 15,75 : : 63
2 126 2

63 9450 126
18900

Ans.

63)198450($ 31,50
189

94
63

315
315

0

Note. In the 5th example the gallons in the first and third terms are reduced to quarts; in this last they are reduced to half gallons, the result will always be the same, let the denominations of those two terms be greater or less, provided they are both of one denomination.

7. How many gallons of wine for $15,75, at $31,50 per hogshead?

31,50 : 63 : : 15,75
63

4725
9450

gal. qts.
31,50)99225(31 2.
9450 Ans.

4725
3150

1575
4

6300
6300

8. How much wine for $ 31,50, when 31½ gallons cost $15,75.

15,75 : 31½ : : 31,50
2 63

63 9450
18900

2)
15,75)198450(126
1575 Ans.63gs

4095
3150

9450
9450

Note. In this example the gallons given 31½, were reduced to halves, therefore the answer came out in half gallons, which when divided by 2, gives the gallons 63.

9. If 8 yards of linen cost £1 12 8, what will 16 yards cost?

8 : 1 12 8 : : 16
20

32
12

392
16

2352
392

3)6272

12)784

2|0)6|5+4

£3 5 4 Ans.

10. If 16 yards of linen cost £3 5 4, what will 8 yards cost?

16 : 3 5 4 : : 8
20
—
65
12
—
784
8
—
12)
16)6272 (392
48
—
147
144
—
32
32

20)312 8
—
£1 12 8 Ans.

11. If I pay £1 12 8, for 8 yards of linen, how many yards can I buy of the same quality for £3 5 4?

1 12 8 : 8 : : 3 5 4
20
—
32
12
—
392

20
—
65
12
—
784
8
—
392)6272(16 yds.
392
Ans.
—
2352
2352

12. If 16 yards of linen cost £3 5 4, how many yards of the same for £1 12 8?

3 5 4 : 16 : : 1 12 8
20
—
65
12
—
784

20
—
32
12
—
392
16
—
2352
392
—
784)6272(8 yds.
6272
Ans.
—

13. If 1C. 2qr. 19lb. of sugar cost £3 19 6½, what will 3C. 1qr. 10lb. cost?

1 2 19 : 3 19 6½ : : 3 1 10
4 20 4
6 79 13
28 12 28
187 954 114
4 26
3818 374
374
15272
26726
11454
187)1427932(7636
1309
1189
1122
673
561
1122
1122
4)
12)1909
2|0)159 1
£7 19 1 Ans.

14. If 3 C. 1 qr. 10 lb. of sugar cost £ 7 19 1, how much will buy 1 C. 2 qrs. 19lb. ? Ans. £3 19 6½

15. If 3 C. 1 qr. 10lb. of sugar cost £7 19 1, how much can I buy for £3 19 6½. ? Ans. 1C. 2qr. 19lb.

16. If 1 C. 2 qrs. 19 lb. cost £3 19 6½, how much for £7 19 1 ? Ans. 3C. 1 qr. 10lb.

17. If $1,50, will buy 6 yards of cloth, how many yards for 3 dols. ? Ans. 12 yards.

18. If 12 yards of cloth cost 3 dols. how many yards for $1,50 ? Ans. 6 yards.

19. If 12 yards of cloth cost 3 dols. how much will 6 yards cost ? Ans. $1,50.

20. If 6 yards of cloth cost $1,50, how much will 12 yards cost ? Ans. 3 dols.

21. If 2 yards of linen cost 1 dol. what will 15 yards cost ? Ans. $7,50.

22. If 15 yards of cloth cost $7,50, what will 2 yards cost ? Ans. 1 dol.

23. If 2 yards of cloth cost 1 dol. how many yards can I buy for $7,50 ? Ans. 15 yards.

24. If $7,50 buy 15 yards of linen, how many yards for 1 dol. ? Ans. 2 yards.

25. If a hogshead of rum, containing 108 gallons, cost $86,40, how much was it a pint ? Ans. 10 cts.

26. At 10 cents a pint, how many gallons of rum for $86,40 ? Ans. 108.

27. At 10 cents a pint, what will 108 gallons of rum cost ? Ans. dolls. 86,40.

28. If 108 gallons of rum cost $86.40, how much can I buy for 10 cents ? Ans. 1 pint.

29. If a man's yearly income be $2460, how much may he spend per day, (allowing the year to be 365 days) to lay up or save 1000 dols. at the year's end ? Ans. 4 dols.

30. A man spent 4 dols. per day, and laid up $1000 at the year's end, what was his yearly income ? Ans. 2460 dols.

31. A man out of his yearly income of $2460, spent 4 dols. per day, how much was left at the year's end ? Ans. 1000 dols.

32. A man spent $4 per day, out of his income, till he had spent $1460, and laid up $1000 in the same

time, how many days was he spending the 1460 dols. and what was his whole income during that time ?

Ans. { The days 365. Income 2400 dols.

33. If 3 acres of land rent for 25 dols. for 1 year, what will be the rent of 12 acres, the same time ? Ans. 100dls.

34. If 12 acres of land rent for 100 dols. how much will be the rent of 3 acres ? Ans. 25 dols.

35. If 100 dols. pay the rent of 12 acres of land, how many acres will 25 dols. pay for ? Ans. 3 acres.

36. If 3 acres rent for 25 dols. how many acres for 100 dols. ? Ans. 12.

37. If I am taxed 10 dols. for 50 acres of land, how much is the tax of the town, in which the land lies, for 23040 acres of land ? Ans. 4608 dols.

38. If 23040 acres of land be taxed 4608 dols. how much must be paid for 50 acres ? Ans. 10 dols.

39. If a town's land tax be $4608, for 23040 acres, how many acres has he, whose tax is 10 dols. ? Ans. 50.

40. If a man who has 50 acres of land, be taxed 10 dols. how many acres are in the town, whose land tax is 4608 dols. ? Ans. 23040.

41. If £3 sterling be equal to $4 Massachusetts, how much Massachusetts is equal to £1000 sterling ?

Ans. £1333 6 8.

42. If £1333 6 8 Massachusetts be equal to £1000 sterling, how much sterling is equal to £4 Massachusetts ? Ans. £3.

43. If £1000 sterling be equal to £1333 6 8, Massachusetts, how much Massachusetts is equal to £3. sterling ? Ans. £4.

44. If £3 sterling be equal to £4 Massachusetts, how much sterling is equal to £1333 6 8 Massachusetts ? Ans. £1000.

45. Required the value of 112C. 3qrs. 23lb. of butter, when 95C. 0qrs. 20lb. cost £88 16 8 ? Ans £105 3 6.

46. If 1 qr. 14lb. of merchandize cost £2 15 9, what will 50C. 3qrs. 24lb. come to ? Ans. £378 16 8¼.

47. What is the value of 3 hogsheads of brandy, containing one 61 gallons, one 62, the other 62¼ gallons, at 6s. 8d. per gallon ? Ans. £61 10 8.

48. If I buy 3 hogsheads of sugar, weighing as fol-

lows; No. 1, 7C. 2qrs, 11lb. No. 2, 8C. 1qr. 10lb. No. 3, 9C. 1qr. 8lb. at £1 17 4, per cwt. how much did the whole come to, and how much was it per pound?

Ans. { The whole come to £ 47 3 0.
The price per pound, 0 0 4.

49. A bale of merchandize weighed 300lb. its first cost was £15 4 9, duties 2d. per lb. freight 25s. porterage 1s. 6d. how much per pound must I sell it to gain 4¼d. per lb? Ans. 1s. 8d.

50. Shipped off 350 casks of butter, weighing in the whole 546C. 2 qrs. 14lb. cost 22s. 6d. per cwt. paid duties 6d. per cwt. cooperage £2 16 0½, boat hire 18s. porterage £2 3 7; cellarage £3 4 7; I demand what 1 cwt. of said butter stands me in on board? Ans £1 3 4.

51. Bought 3 sorts of brandy, of each an equal quantity; one sort at 5s. per gallon, one at 6s. and the third at 7s. per gallon; what is the average price per gallon? Ans. 6s.

52. Bought 3 sorts of vinegar, of each an equal quantity, at 3½d. 4d, 4½d. per quart, and mixed them together; what does a quart of this mixture stand me in? Ans. 4d.

53. Paid for 4 tons of tallow, £120; for 5 tons more, £150 5, and for 6 tons more, £192 10; what is the average price per ton? Ans. £30 17.

54. Bought 102 bushels of corn, for $62,20, 140 bushels more, for $70, 260 bushels for $143,90; having mixed the whole together, I demand the average cost per bushel? Ans. 55 cents.

55. A cashier has £109 12, in divers species, which he exchanged for crowns, at 5s. 5d. and ducatoons at 6s. having an equal number of each, how many of each had he? Ans. 192.

56. A captain of a ship has 24000lb. of bread for 200 seamen, of which each man eats 4lb. per week, how long will the bread last? Ans. 30 weeks.

57. In a fort there are 700 men, provided with 184000lb. of provisions, of which they consume each man 5lb. a week, how long can they subsist?

Ans. 52 weeks, and 4 days.

58. If 25 men have ¾lb. of beef each, three times in a week, how long will 3150lb. last them? Ans. 56 weeks.

59. Suppose 150 seamen are provided with 984 gallons, and 3 pints of brandy, for 7 months, (each month 30 days) what is each share per day? Ans. 1 gill.

60. How many tiles of 8 inches square, will lay a floor 20 feet long, and 16 feet broad? Ans. 720.

61. How many yards of cloth, 2 feet wide, will hang a wall that is 24 by 20 feet. Ans. 80 yards.

62. A piece of land which is 80 perches by 70, is to be divided into parcels of 20, by 14 perches; how many parcels can there be? Ans. 20.

63. How many tiles of 9 inches square will lay a floor of 50 feet by 20. Ans. $1777\frac{7}{9}$.

64. How many stones of 10 inches long, 9 inches broad, and 4 inches thick, would be wanting to build a wall of 80 feet long, 20 feet high, and $2\frac{1}{4}$ feet thick?

Ans. 17280 stones.

65. If in 4 months I spend 3 month's gain, how much can I lay up at the year's end, if I gain £150, every 6 months? Ans. £75.

66. If 840 eggs are bought at the rate of 10 for a penny, and 240 more at the rate of 8 for a penny, and sold the whole at the rate of 18 for 2 pence, what is the gain or loss? Ans. 6d. gained.

67. If 30 yards of cloth cost £15, how much will a Dutch Ell come to, if 3 yards are equal to 4 Ells?

Ans. 7s. 6d.

68. A fountain has 4 cocks, viz. A, B, C, and D, and under the fountain stands a cistern, which can be filled by the cock A, in 6 hours; B in 8 hours; C in 10; and D in 12 hours. And the cistern has 4 cocks, viz. E, F, G, and H; and can, when full, be emptied by the cock E in 6 hours, F in 5, G in 4, and H in 3 hours. Suppose the cistern full of water, and all the cocks both in the fountain and cistern, to be opened at the same instant of time, in what time will the cistern be empty?

Ans. $2\frac{30}{283}$ hours.

69. A merchant shipped 400 cloths at £12 each, for Spain, to have returns one half in wines at £30 per ton, and the other half in rice, at 28s. per cwt. how much had he of each returned?

Ans. { Wine 80 tuns.
Rice, 1714C. 1 qr. 4lb.

70. Bought 3 score pieces of Holland for three times as many pounds, and sold them again for four times as many pounds; but if they had cost as much as I sold them for, what should I have sold them for, to gain after the same rate? Ans. £320.

71. If 2lb. of pepper cost 25d. what will 60lb. of cloves cost, if 3lb. of cloves are worth 16lb. of pepper?
Ans. £16 13 4.

72. Bought 45 barrels of beef, at 24s. per barrel, among which are 16 barrels, whereof 4 are worth no more than 3 of the others; how much must I pay?
Ans. £43 1.

73. Suppose a grey hound makes 27 springs, while a hare makes 25 (of equal length) and when they both begin to run, the hare is 50 springs before the hound, how many springs will the hound make before he overtakes the hare? Ans. 675.

74. A sets out on a journey, and travels 27 miles a day; 7 days after, B sets out, and travels the same road 36 miles a day; in how many days will B overtake A? Ans. 21.

75. If 69C. 0qrs. 21lb. cost £607 10, what quantity can I buy for 176 guineas and 2s. each guinea 23s?
Ans. 23C. 0qr. 7lb.

76. If 32s. 8d will buy 28lb. of galls, what quantity can I have for £88 13 4? Ans. 13C. 2qrs. 8lb.

77. How many tons of merchandize can I have for £00 8 5¼ if 7 tons cost £285? Ans. 22 T. 2C. 1 qr. 7lb.

78. If one sixteenth of a ship cost $1500, how much was the whole valued at? Ans. $24000.

79. Bought a parcel of cloth at the rate of 6s. for 2 yards, of which I sold a quantity at the rate of 18s. for 5 yards, and gained as much as 18 yards cost, how many yards did I sell? Ans. 90 yards.

80. If a hogshead of wine is sold for £ 0, and 6 per cent lost, how much is the gain or loss per cent, when 5 hogsheads are sold for £45 10?
Ans. lost $14\frac{23}{50}$ per cent.

81. If one pound ten and 40 groats
Will buy a load of hay,
How many pounds with 19 crowns
For 20 loads will pay? Ans. £28 11 8.

Note. After finding the value of the 20 loads in pounds, &c. the 19 crowns at 5s. each are subtracted from it, to obtain the answer above.

82. At 18d. a square foot, how much is the value of a piece of plank, which is 5¼ feet long, 2½ feet wide at one end, and 1½ foot at the other? Ans. 15s. 9d.

83. A travels 24 miles a day; and 15 days after A sat out, B travels after him; how many miles a day must B travel, to overtake A in 60 days? Ans. 30 miles.

84. What is the value of 1½cwt. of coffee, at 1½ cent per ounce? Ans. $40,32.

85. At $11,20 per cwt. how much will 2C. 2qrs. 13lb. of wool cost? Ans. $29,30.

86. If I buy 8 bales of cloth, each containing 12 pieces, and each piece 27 yards, at 54. dols. per piece, what was the value of the whole, and of one yard?

Ans. the whole 5184 dols.; per yard 2 dols.

87. Bought 126 gallons of rum for $110, how much water must be added to it, to reduce the first cost to 75 cents per gallon? Ans. 20⅔ gallons.

88. If I sell coffee at 2s. 3d. per lb. and gain 35 per cent, what did I give per lb? Ans. 20d.

89. A grocer bought 4 hogsheads of sugar, each weighing net 9C. 3qrs. 14lb. at the rate of $11,50, per cwt. and 5 bags of coffee, each 100lb. at 27 cts. per lb. How much did he pay for the whole, after having 25 per cent discount allowed on the price of the coffee, which proved to be damaged? Ans. $555,50.

90. Suppose 2000 soldiers had been supplied with bread, sufficient to last them 12 weeks, allowing each man 14 ounces a day, but on examining find 105 barrels containing 200lb. each wholly spoiled; how much a day may each man eat, that the remainder may supply them the 12 weeks? Ans. 12 ounces.

91. 2000 soldiers were put to an allowance of 12 ounces of bread per day, for 12 weeks; having a seventh part of their bread spoiled, what was the whole weight of their bread, (good and bad) and how much was spoiled?

Ans: { The whole 147000lb.
{ Spoiled 21000

92. 2000 soldiers, having lost 105 barrels of bread, weighing 200 lb. each, were obliged to subsist on 12oz. a day for 12 weeks. Had none been lost, they might have have had 14 ounces a day, the same time. What was the whole weight including what was lost, and how much had they left to subsist on?

Ans. { The whole weight, 147000 lb.
Left to subsist on, 126000

93. 2000 soldiers (after losing one seventh part of their bread) had each 12 ounces a day for 12 weeks. What was the whole weight of their bread including that lost, and also the weight lost; and how much might they have had per day each man, if none had been lost?

Ans. { The weight was 147000 lb.
The loss, 21000.
Had none been lost they might have had 14 oz. per day.

94. If one degree of a great circle of the earth be 69½ English statute miles, how many statute miles is the circumference of the earth, it being 360 degrees?

Ans. 25020 miles.

95. If the circumference of the earth be 25020 English statute miles, and 69½ such miles make one degree, how many degrees is it? Ans. 360.

96. If 25020 English statute miles make 360 degrees, how many such miles make one degree?

Ans. 69½.

97. If 25020 English statute miles make 360 degrees, how many degrees will 69½ such miles make?

Ans. 1.

98. Shipped for the West Indies, 2000 barrels of beef, which cost me $10,50, per barrel, paid cooperage $20,37, truckage $100, wharfage $80: I demand how much the beef cost per barrel when on board.

Ans. { $10,60,0 ,185. Or 10 dollars 60 cents, no mills, 185 thousandths of a mill.

Here follow a few examples to exercise the pupil in decimals.

1. If ,9 of a pound of coffee cost ,15 of a pound, how much will 253,7 lb. cost?

,9 : ,15 : : 253,7
,15

12685
2537

9)38,055

42,2833
20

5,6660
12

7,9920

Ans. £42 5 7 ,992.

2. What is the value of ,9 of a pound of coffee, when 253,7lb. cost £42 5 7 ,992?

253,7 : 42,833 : : ,9
,9

253,7)38,05497(,1499 of a £.
2537

12684
10148

25369
22833

25367
22833

2534

Ans. £0 ,1499, or £0 ,15 nearly.

3. If ,25 of a gallon of wine cost ,8 of a dollar, what will ,85 of a gallon cost? Ans. $2,72.

4. If ,85 of a gallon of wine cost $2,72, how much will ,25 of a gallon cost? Ans. $0,80, i. e. ,8 of a dollar.

Note. The third and fourth examples exactly prove each other, though sometimes the answer in one, not being perfect, will not prove by varying their order.

5. If tea be sold for 73,4 cents per pound, how much will 61,3 pounds cost? Ans. $44,99 ,42.

6. If 61,3 pounds of tea cost $44 ,9942, what is the price per pound? Ans. 73,4 cents.

7. If 2,5 pounds of tobacco cost ,75 of a dollar, how much will 18,5 cost? Ans. $5 ,55.

8. If 18,5 pounds of chocolate cost $5 ,55, how much will 2,5 pounds cost? Ans. ,75 cents.

9. What is the value of ,15 of a hogshead of lime, at $2,39 per hogshead? Ans. 35,85 cents.

10. If ,15 of a hogshead of lime cost 35,85 cents, what is it per hogshead? Ans. $2,39.

11. If ,75 of a ton of hay cost $15, what is it per ton? Ans. 20 dolls.

12. If a barrel of rum cost 20 dolls. what is ,75 of a barrel worth ? Ans. 15 dolls.

13. Three men at a tavern, had run up a score, which they (being ignorant in numbers) proposed to pay as follows ; A to pay ,25, B ,5 and C ,75, to which the host agreed. Did he gain or lose by this mode of payment, and how much ? Ans. he gained ,5 of the bill.

SINGLE RULE OF THREE INVERSE.

Inverse Proportion is known by more requiring less, or less requiring more ; after stating the terms as directed in Direct Proportion.

Multiply the first and second terms together, and divide the product by the third, the quotient will be the fourth term or answer.

The proof of examples in this, is the same as in Direct Proportion.

Note. If there are several denominations in any, or all the terms, they must be reduced to the lowest, as directed in Direct Proportion.

Examples.

1. If 100 dolls. in 12 months gain 6 dolls. interest, what principal will gain the same in 8 months ?

mo. $ mo.
12 : 100 :: 8
12

8)1200

$150 Ans.

2. If 150 dolls. in 8 months, gain 6 dolls. interest, what principal will gain the same in 12 months ?

8 : 150 :: 12
8

12)1200

dolls. 100 Ans.

3. If 150 dolls. in 8 months gain 6 dolls. interest, in what time will 100 dolls. gain the same ?

150 : 8 : : 100

8

1|00)12|00

12 months, Ans.

4. If 100 dolls. in 12 months gain dolls. in what time will 150 dolls. gain the same ?

100 : 12 : : 150

12

15|0)120|0(8 months, Ans.

120

5. If 7 men can do a piece of work in 10 days, how many men can do the same in 5 days ? Ans. 14.

6. If 14 men can do a piece of work in 5 days ; how many men can do the same in 10 days ? Ans. 7.

7. If a man perform a journey in 15 days, when the days were 12 hours long, how long ought the days to be, to travel the same distance in 12 days ? Ans. 15 hours.

8. If a man perform a journey in 12 days, when the days were 15 hours long, another man travelling at the same rate, is 15 days going the same distance, how long were the days when the second man travelled ?

Ans. 12 hours.

9. A farmer hired a man for a year, was to give him a coat worth 15 dolls. and 120 dolls. but disagreeing, they parted ; the farmer gave him besides the coat, $ 52,50, how long did he tarry ? Ans. 6 months.

10. A man has a garment making, which takes 2 yards of cloth of 1½ yard wide ; as he wishes it to be lined with shalloon of ¾ of a yard wide, how much will complete the lining ? Ans. 4 yards.

11. If 48 men can build a wall in 24 days, how many men can do the same in 192 days ? Ans. 6 men.

12. If I lend my friend 100 dolls. for 6 months, (allowing 30 days to a month) how long ought he to lend me 1000 dols. to requite my kindness? Ans. 18 days.

13. How many yards of matting, that is half a yard wide, will cover a room that is 30 feet long, and 18 wide ? Ans. 120 yds.

14. How much in length, that is 3 inches wide, will make a square foot? Ans. 4 feet.

THE RULE OF PROPORTION;
Or,

THE RULE OF THREE, STATED BY A METHOD WHICH RENDERS ALL DISTINCTIONS OF *DIRECT, INVERSE, SINGLE, OR DOUBLE PROPORTION*, UNNECESSARY.

CASE I. When three numbers or terms only are given.

RULE. Write down that number or term which is of the same kind or quality, the answer is to be, for the middle term, and reduce it to its lowest denomination.

2. Consider whether by the nature of the question, the answer must be more than the middle term, if so set down the greater of the other two numbers at the right of the middle term, and the less at the left; but if the answer must be less than the middle term, set the less number at the right, and the greater at the left.

3. Multiply the middle and right hand terms into each other for a dividend, which divide by the left hand term, the quotient will be the answer in the same denomination the middle term was reduced to, which may (if need be) be reduced to its proper terms.

NOTE. If any or all the terms be of several denominations, they must be reduced as in the Rule of Three Direct, &c.

Questions in this rule may be proved by varying their order.

EXAMPLES.

1. If 28s. will pay for the carriage of 1 cwt. 150 miles, how far can 6cwt. be carried for the same money?

6 : 150 :: 1

1

6)150

Ans. 25 miles.

2. There is a cistern having a cock which will empty it in 12 hours, how many such cocks will empty it in 15 minutes?

12
60
---
15 : 1 :: 720
1
---
15)720(48 Ans.
60

120
120

Miscellaneous Questions, which, according to most authors, would some be called direct, and some inverse Proportion, but may all be solved by this last method.

1. If 120 men can do a piece of work in 8 months, how many men can do the same in 2 months?

2 : 120 :: 8
8
---
2)960
---
480 Ans.

2. If 25 dolls. worth of wine will serve 46 men, when wine is 190 dolls. per tun, how many men will the same 25 dolls. worth serve, when the wine is 80 dolls. per tun?

80 : 46 :: 120
120
---
80)5520

Ans. 69 men.

3. At 15s. 11d. per cwt. what will 5 fother cost?

C.	s.	d.
1	15	11
4	12	

4 qrs. 191d. : : 390 qrs.

cwt. qrs.
19 2 in a fother.
4
78
5
191
390
3510
390
4)74490
12)18622½
2|0)155|1 10
£77 11 10½ Ans.

Note. This 3d example would be by former authors in general called Direct Proportion.

4. How many yards of shalloon, that is ¼ of a yard wide, will line 9 yards of ¾ wide? Ans. 21 yards.

5. If £652 13 4 is taxed £83 12 4, how much must £4 be taxed? Ans. 10s. 2d. ¼qr. $\frac{15088}{15665}$.

6. Two travellers set out from the same place, and at the same time, one travels East, 24 miles a day, the other West, 30 miles a day, till they were 2150 miles from each other, how long did they travel, allowing 12 hours to a day? Ans. 39d. 9h. 46m. 40s.

7. At 10 cents a dozen, how many gross for $62,40? Ans. 52 gross.

8. At 378 dolls. per tun, how many gallons of wine for $37,50? Ans. 25 gallons.

9. If 7 times 6 barrels of flour cost 4 times 63 dolls. how much will 9 times 23 barrels cost? Ans. 1242 dols.

10. A merchant bought 8000 barrels of flour for 27000 dolls. but by accident 1000 barrels were damaged, so as to be wholly lost; how must he sell the remainder per barrel, to gain 1000 dolls.? Ans. 4 dolls.

11. If 12 dozen lb. 3 score lb. and 16 lb. of coffee cost 11 times 5 dolls. how much will 5 dozen lb. 7 times 9lb. and 11lb. cost? Ans. $33,50.

12. Admit within atherial space,
A harmless dove to soar,
And by a furious eagle chas'd,
Who him in pieces tore:
Admit that when the chase began,
The space between the twain,
Did forty furlongs and a span,
Accurately contain:
And that such was the eagle's force,
That while the dove did fly
Four rods, the eagle ten in course,
Of his celerity,
Did just accomplish with ado:
And now, without delay,
Tell me how far the eagle flew,
Before he caught his prey?
Ans. $2666\frac{147}{158}$ rods.

CASE II. When more than three numbers, or terms are given, as five, seven, nine, &c. which is generally called Compound or Double Rule of Three.

RULE. Select the middle term as in Case I.

2. Take two terms of like qualities, and dispose of them as directed in that Case.

3. Take two other terms of like qualities, and dispose of them in like manner, and so on till all the terms are disposed of, and reduced as directed.

4. Multiply the middle term into all those at the right of it, the last product will be a dividend.

5. Multiply all the terms at the left of the middle one together, for a divisor.

6. Divide the dividend by the divisor, the quotient will be the answer, as in Case I.

NOTE. Questions of this kind may be proved by varying their order. See first and second examples.

EXAMPLES.

1. If 7 men in 12 days, can reap 84 acres, how many men in 5 days can reap 100 acres?

days. acres. men. acres. days.
5 : 84 : 7 : : 100 : : 12
5 100

42|0 700
12

42|0)840|0(20 Ans.
84

0

2. If 7 men in 12 days can reap 84 acres, how many acres can 20 men reap in 5 days?

days. men. acres. men. days.
12 : 7 : 84 : : 20 : : 5
7 20

84 1680
5

84)8400(100 Ans.
84

00

3. If 12 men in 5 days can reap 100 acres, how many men in 12 days can reap 84 acres? Ans. 7 men.

4. If 20 men in 5 days can reap 100 acres, how many acres can 7 men reap in 12 days? Ans. 84.

5. If 20 men can build a wall 100 ft. long, 6 ft. high, and 4 feet thick, in 12 days, how many men can build a wall the same length, 8 feet high, and 3 feet thick, in 6 days?

days. thick. high. men. high. thick. days.
6 : 4 : 6 : 20 : : 8 : : 3 : : 12
4 8

24 160
6 3

144 480
12

144)5760(40 Ans.
576

0

6. If 40 men can build a wall in 6 days, 100 feet long, 8 feet high, and 3 feet thick, how many men can build a wall the same length, 6 feet high, and 4 feet thick in 12 days? Ans. 20 men.

7. If 20 men in 12 days, of 15 hours each, can build a wall 100 feet long, 10 feet high, and 6 feet thick, how many men can build a wall in 15 days, of 12 hours each, 200 feet long, 12 feet high, and 5 feet thick.

hours. days. thick. high. long. men. long. high. thick. days. hours.

12 : 15 : 6 : 10 : 100 : 20 :: 200 :: 12 :: 5 :: 12 :: 15

10	20
1000	4000
6	12
6000	48000
15	5
90000	240000
12	12
108|0000	2880000
	15
	1440
	288

108|0000)4320|0000(40 Ans.
432
0

8. If 40 men in 15 days, of 12 hours each, can build a wall 200 feet long, 12 feet high, and 5 feet thick, how many men in 12 days, of 15 hours each, can build a wall 100 feet long, 10 feet high, and 6 feet thick?
Ans. 20 men.

9. If 10 bushels of oats supplies 18 horses 20 days, how many bushels will serve 60 horses 36 days?
Ans. 60 bushels.

If 98 lb. of bread will be sufficient for 7 men 14 days, how much will suffice 21 men 3 days? Ans. 63lb.

SIMPLE INTEREST.

Simple Interest is a profit allowed (or paid) for the use of money loaned, or for forbearance of payment.

The allowance for £100, or 100 dolls. for one year is called the ratio, or rate per cent; sometimes distinguished by r. The sum loaned, or that for which payment is forborne, is called the principal; sometimes distinguished by p.

The years and parts of a year, &c. for which interest is paid, is called the time; sometimes distinguished by t.

The principal and interest added into one sum, is called the amount; sometimes distinguished by a.

Various methods have been given by authors, to find the interest of a given sum; some of those methods are not so general, as might be wished; for instance, multiplying the principal by half the number of months, and dividing the product by 100, will give the interest for the time when the rate is 6 per cent; but in no other case, or at any other rate per cent.

The best general rule for calculating interest (which holds good not only in finding the interest of any sum proposed, but also in calculating commissions, ensurance, discount, &c. at any rate per cent) is the following.

Case I. When the interest of any sum is required for one year.

1. If the given principal is dollars.

Multiply by the rate per cent, and divide by 100, which division is made by pointing off the two right hand figures; those at the left of the point will be dollars, those pointed off, decimals of a dollar, (or cents.)

2. If there are cents, or cents and mills, or mills only given in the principal.

Multiply by the rate as before, and if cents were given, point off four; if mills were given, point off five places* of right hand figures; those at the left of the point (if any) are dollars; the next two places of figures are cents, the next one mills; if any are at the right of the mills, it is a decimal of a mill.

* If there are not so many places as required, to be pointed off, supply them by prefixing ciphers.

Note. The questions in this case may be proved by division, when dollars are given.

Examples.

1. What is the interest of 537 dolls. for one year, at 6 per cent. per annum?

537 × 6 = 3222 ÷ 6 = 537 proof.

dolls. 32,22 Ans.

2. Required the interest of $ 43,21, for a year, at 5 per cent.

43,21 × 5

dolls. 2,16,0,5 Ans.

Or 2 dollars, 16 cents, 0 mills, 5 tenths of a mill.

3. Required the interest of 93 cents for a year, at 6 per cent. per annum.

,93 × 6

,05,5,8 Ans. 5 cents, 5 mills, $\frac{8}{10}$.

4. What is the interest of 9 mills for a year, at 4 per cent?

9 × 4

,00,0,36 Ans. ,36 of a mill, or thirty six hundredth parts of a mill.

3. If the given principal is sterling money, or any currency in pounds, shillings, pence, &c.

Multiply the whole of the principal, by the rate per cent, (as in Compound Multiplication) and point off the two right hand figures in the pounds of the product, (which is dividing by 100) those at the left of the point, will be pounds interest.

Reduce those two figures pointed off, to shillings, taking in or adding the figures in the shilling's place of the product if any; then point off two figures from the right of this product, those at the left of the point will be shillings interest; then reduce the last figures

pointed off to pence, taking in the pence in the product, if any, and point off as above, for pence of interest, &c.

Note 1. *The best method is, instead of points, to draw a line downward, so as to cut off the two right hand figures of the pounds in the product; then in reducing to shillings, pence, &c. set two figures of each product on the right of this line, those at the left (if any) will be shillings, pence, &c.*

Note 2. *To prove these examples, multiply the interest by 100, and divide by the rate per cent, the quotient will be equal to the principal; if there is a remainder in the interest, add it to the product.*

EXAMPLES.

1. What is the interest of £936 18 7½, for a year, at 6 per cent. per annum?

£936 18 7½ principal.
6 rate.

56	21 11 9	
	20	£56 4 3¾ 24/100
	431	10
	12	562 3 1½
3	81	10
	4	6)5621 11 9
5	24	£936 18 7½ proof.

Ans. £56 4 3¾ 24/100 interest.

2. What is the amount of a note of £738 9 4 for a year, at 6 per cent. per annum?

Principal at 738 9 4
Rate 6

44	30 16 0	
	20	
6	16	
	12	
1	92	Interest £ 44 5 1¼ 68/100
	4	Principal 738 9 4
3	68	Amount 782 15 5¼ 68/100 A.

3. What is the interest of £163 18 4½, for a year, at 6 per cent. per annum? Ans. £9 15 10¾ $\frac{32}{100}$.

4. What is the amount of 7s. 3½d. for a year, at 6 per cent. per annum? Ans. 7s. 8¾d.

5. What is the amount of £756, at 5 per cent. per annum, for one year? Ans. £793 16.

Miscellaneous Questions.

1. What is the interest of 736 dolls. for a year, at 5 per cent. per annum? Ans. dolls. 36,80.

2. What is the interest of £11 13 4, for a year, at 4 per cent. per annum? Ans. 9s. 4d.

3. What is the amount of dolls. 936,22, at 5 per cent. per annum? Ans. dolls. 983,03,1.

4. What is the interest of dolls. 7365,27, for a year, at 6 per cent. per annum? Ans. dolls. 441,91,6$\frac{2}{10}$.

5. What sum will dolls. 593;12 amount to in a year, at 5 per cent. per annum? Ans. dolls. 622,77,6.

6. What sum will £436 2 1¼ amount to in a year, at 6 per cent. per annum? Ans. £462 5 5¼ $\frac{37}{100}$.

CASE II. When the given time is several years.

Multiply the principal by the number of years, and that product by the ratio, (or rate per cent) and then point off, &c as in Case I.

*NOTE. To prove these examples, divide by the number of years, after dividing by the rate per cent.**

EXAMPLES.

1. What is the interest of 936 dolls. for 7 years, at 6 per cent. per annum?

	936	6)393,12
Time,	7	7)6552
	6552	936 Proof.
Ratio.	6.	
	$393,12 Ans.	

* This Case may also be proved by Case VII.

2. What is the interest of $736,21,3 for 3 years, at 7 per cent. per annum? Ans. 154,60,4 $\frac{73}{100}$.

3. What is the amount of £936 11 8½ for 5 years, at 5 per cent. per annum? Ans. £1170 14 7½ $\frac{60}{100}$.

4. What is the amount of $936,21, for 9 years, at 4 per cent. per annum? Ans. $1273,24,5 $\frac{56}{100}$.

5. What will £1136 18 4, amount to in 18 years, at 6 per cent. per annum? Ans. £2364 15 8¼ $\frac{20}{100}$.

CASE III. When the given time is years, and parts of a year.

Multiply the principal by the years, and take parts for the parts of a year, and add the several sums together; then multiply this sum of the several parts, by the rate, and point off, &c. as in the preceding cases.*

EXAMPLES.

1. What is the interest of $936,40, for 3½ years, at 6 per cent. per annum?

½ year is ½	936,40	6)1966440
	3½	
	280920	327740
	46820	½ year 2
	halves	7)655480
	327740	
	6	$936,40 Proof.

Ans. $196,64,4,0

2. What is the amount of $437,21 for 6 years, 8½ months, at 6 per cent. per annum?

* To prove these examples after dividing by the rate per cent, multiply the quotient by so many as the parts of a year are, and divide the product by so many as the years, and parts will make of such parts, the quotient will be equal to the principal.

6 months are $\frac{1}{2}$ | 437,21
6

262326
2 months are $\frac{1}{3}$ 218605
$\frac{1}{2}$ month is $\frac{1}{4}$ 7286833
1821708

293295,041
6

175,97,7,0,246
437,21

$613,18,7 Ans.

3. What is the interest of £113 16 3 for 5 years, 5 months, and 5 days, at 6 per cent. per annum?

4 months are $\frac{1}{3}$ | 113 16 3
5

569 1 3
1 month is $\frac{1}{4}$ 37 18 9
5 days are $\frac{1}{6}$ 9 9 8$\frac{1}{4}$
1 11 7$\frac{1}{4}$

618 1 3$\frac{1}{2}$
6

37 | 08 7 9
20

1 | 67
12

8 | 13

Ans. £37 1 8$\frac{13}{100}$.

4. What is the amount of £536 12 6, for 4 years, 7 months, 18 days, at 5 per cent. per annum?

6 months are $\frac{1}{2}$ | 536 12 6
4

2146 10 0
1 month is $\frac{1}{6}$ 268 6 3
15 days $\frac{1}{2}$ 44 14 4$\frac{1}{2}$
3 days $\frac{1}{5}$ 22 7 2$\frac{1}{4}$
4 9 5$\frac{1}{4}$

2486 7 3
5

124 | 31 16 3
20

6 | 36
12

4 | 35
4

1 | 40

124 6 4$\frac{1}{4}$ $\frac{40}{100}$
536 12 6

£660 18 10$\frac{1}{4}$ $\frac{40}{100}$ Ans.

CASE IV. When the time is years and parts, and the rate per cent has also fractional parts.

Proceed with the time as in Case III, then multiply by the integer of the rate, and take parts for the fractional parts.

EXAMPLES.

1. What is the interest of $963,11, for 7 years and 10 months, at $5\frac{3}{4}$ per cent. per annum?

2. What is the interest of £537 8 $4\frac{1}{2}$, for 3 years, 4 months, and 25 days, at $6\frac{1}{4}$ per cent. per annum?

6 months are $\frac{1}{2}$ | 963,11
4 months " $\frac{1}{3}$ | 7

674177
48155,5
32103,6

$\frac{1}{2}$ | $\frac{1}{2}$ | 754436,1
$5\frac{3}{4}$

37721805
$\frac{1}{4}$ | $\frac{1}{2}$ | 37721805
18860902

Ans. $433,80,0,757

4 months are $\frac{1}{3}$ | 537 8 $4\frac{1}{2}$
3

1612 5 $1\frac{1}{2}$
20 days* " $\frac{1}{6}$ | 179 2 $9\frac{3}{4}$
5 days " $\frac{1}{4}$ | 29 17 $11\frac{1}{2}$+
7 9 $5\frac{1}{4}$+

$\frac{1}{4}$ | $\frac{1}{4}$ | 1828 14 $3\frac{3}{4}$+
$6\frac{1}{4}$

10972 5 $10\frac{1}{2}$
457 8 $6\frac{1}{4}$+

114 | 29 9 $5\frac{1}{4}$+
20

5 | 89
12

10 | 73
4

2 | 93

Ans. £114 5 $10\frac{1}{2}$ $\frac{93}{100}$+

The following rule for calculating interest is inserted to accommodate those who may prefer it.

To find the interest of any sum, for any number of months, at any rate per cent.

* In taking parts of a month for the days, the month is here called 30 days.

RULE. Multiply the principal by the number of months, divide the product by the number in the following table,* answering to the rate per cent.

Point off the right hand figures, as in the other method.

	Per cent.	Divide by
For	2	6
	3	4
	4	3
	5	2,4
	6	2

EXAMPLES.

1. Required the interest of $500 for 16 months, at 6 per cent.

500
16
6)8000
Ans. $13,33,3

2. Required the interest of $1000 for 10 months, at 3 per cent. Ans. $25.

3. Required the interest of $936 for 17 months, at 4 per cent. Ans. $53,04.

4. Required the interest of $1173,57, for 18 months, at 5 per cent. Ans. $88,01,4¼.

5. Required the interest of £1136 16 8, for 21 months, at 6 per cent. Ans. £119 7 4 2/10.

CASE V. When the given time is weeks only.

Find the interest for a year by Case I, then multiply the year's interest by the number of weeks, and divide by 52.

* These divisors are found by dividing 12 (the months in a year) by the rate per cent, and may be found for any rate per cent.

Examples.

1. Required the interest of $936,21 for 11 weeks, at 6 per cent. per annum?

936,21
6 rate.
56,17,2,6
11 weeks.
52)617,89,8,6($11,88,2+ Ans.
52
97
52
458
416
429
416
138
104
34

2. What is the interest of $536,11, for 9 weeks, at 6½ per cent. per annum?

½ is ½ | 536,11
6½ rate.
321666
26805
348471
9 weeks.
$
52)313,6239(6,03,1+
312 Ans.
162
156
63
52
11

Case VI. When the given time is days only.

Multiply the principal by the days, and that product by the rate per cent.; then divide this second product by 36525*.

* 36500 is used by most writers on this method, on a supposition, that 365 days make one complete year; but as the year is nearly 365¼ days, instead of annexing two ciphers to the 365, I annex ,25, which makes it 36525, and gives the interest nearer the truth, than 36500 will.

EXAMPLES.

1. What is the interest of dolls. 936,14, for 17 days, at 6 per cent. per annum?

936,14
17
655298
93614
1591438
6
36525)9548628($2,61,4+
73050
224362
219150
52128
36525
156030
146100
9930
Ans.

2. What is the amount of 572 dols. for 120 days, at 6 per cent. per annum?

572
120
68640
6
36525)411840($11,27,5+
36525
46590
36525
100650
73050
276000
255675
203250
182625
20625
11,27,5+ Interest.
572 Principal.
$583,27,5+ Ans.

3. What is the interest of 256 dols. from June 1, to Sept. 10, inclusive, at 6 per cent. per annum?

Ans. dolls. 4,28,9+

When partial payments have been made, in order to find what is due, proceed as follows, viz. Compute the interest from the time it commences, to the time the payment is made, which including all previous payments, (if any) exceeds the interest then due; add this interest to the first principal, and from the amount subtract the payment (or sum of payments) to that time; the remainder will be a new principal, for which compute and subtract as before, &c.*

* This has been practised in the Massachusetts courts of law, as an established rule.

EXAMPLES.

1. A note for 1500 dols. dated July 10, 1806, payable on demand with interest till paid, has the following payments endorsed on it, viz.

Received, March 1, 1807, $50, July 20, 1807, $300, Sept. 1, 1807, $400.

The debtor is ready to pay the balance Jan. 1, 1808; how much is then due?

First principal on interest from July 10, 1806, to July 20, 1807, - -	$1500	
Interest from July 10, 1806, to July 20, 1807, being 1 year and 10 days, for $1500, is - - - - - -		92,50
	Amount,	1592,50
Paid Mar. 1, 1807, $50 less than interest, then due; July 20, 1807, $300, both these exceed the interest due, when the second payment was made, their sum is		350
	Remains a new principal,	1242,50
Interest on $1242,50, from July 20, 1807, to Sept. 1, 1807, being 1 month and 11 days, is - - - - -		8,49
	Amount,	1250,99
Paid Sept. 1, 1807, - - - -		400
	Remains a new principal,	850,99
Interest on $850,99 from Sept. 1, 1807, to Jan. 1, 1808, being 4 months, - -		17,01
	Answer,	$868,00

2. How much is due June 1, 1807, on a note for $2000, dated June 1, 1805, on which the following payments are endorsed, viz. Received Sept. 1, 1805, $96, Decem.r 10, 1805, $15, April 20, 1806, $36, July 1, 1806, $200, Jan. 10, 1807, $20, March 25, 1807, $90. Answer, $1767,48.

CASE VII. When the amount, time, and rate per cent. are given, to find the principal.

RULE. As the amount of 100 at the rate and time given, is to 100; so is the given amount to the principal required.

NOTE. This Case proves Case II.

EXAMPLES.

1. How many dollars, &c. will amount to $890,81,7,73 in 3 years, at 7 per cent. per annum?

Principal 100
Time 3
300
Rate 7
Interest 21|00
Princi. 100|00

121 : 100 :: 890,81,7,73
100

121)89081,7,73|00($736,21,3 Ans.
847
438
363
751
726
257
242
157
121
363
363

NOTE 1. This and the two following cases may (by some) be thought unnecessary, but it is presumed no instructor will regret the scholar's going through them by way of exercise; nor will an ambitious scholar be sorry he has studied them.

The advantage derived from variety in studies of this kind, are almost incalculable.

NOTE 2. Instructors are not bound to teach their pupils every rule which a book contains; the business they will probably follow ought to be a guide to the rules necessary for them to learn.

2. What principal being put to interest 5 years, at 5 per cent. per annum, will amount to £1170 14 $7\frac{1}{2}\frac{50}{100}$?

100
5
500
5
25|00
100
125 : 100 :: 1170 14 $7\frac{1}{2}\frac{50}{100}$
20 20
2500 23414
12 12
30000 280975
4 4
120000 1123902 50
100
12000|0)11239025|0 00(£936 11 $8\frac{1}{2}$ Ans.
108000
43902
36000
79025
72000
7025
20
140500
12000
20500
12000
8500
12
102000
96000
6000
4
24000
24000

Note. This Case may be proved by Case II.

CASE VIII. When the principal, time and amount are given, to find the rate per cent.

RULE 1. As the principal is to the interest for the whole time, so is 100 to its interest for the same time.

2. Divide the interest thus found by the given time; the quotient will be the rate per cent.

EXAMPLES.

1. At what rate per cent. per annum, will 500 dols. amount to $725 in 9 years.

Amount 725
Principal 500

225 Interest for $500 for 9 years.

500 : 225 :: 100
100

5|00)225|00

years 9)45 Interest of 100 dols. for 9 years.

Ans. 5 per cent.

2. At what rate per cent. per annum, will £620, amount to £793 12 in 7 years? Ans. 4 per cent.

3. At what rate per cent. per annum, will 420 dols. amount to $520,80, in 8 years? Ans. 3 per cent.

CASE IX.

When the principal, rate and amount are given, to find the time.

RULE. As the interest of the principal for 1 year is to one year, so is the whole interest to the time or number of years required.

EXAMPLES.

1. In what time will 500 dols. amount to 725 dols. at 5 per cent. per annum?

500
5

2500 725 Amount.
500 Principal.

1 year's interest, } 25 : 1 :: 225 whole interest.
1

25)225(9 years, Ans.
225

Note. This Case and Case VIII, prove each other.

2. In what time will £620, amount to £793 12, at 4 per cent per annum? Ans. 7 years.

3. In what time will 420 dols. amount to $520,80 at 3 per cent. per annum? Ans. 8 years.

4. In what time will 2500 dols. amount to 5200 dols. at 6 per cent. per annum? Ans. 18 years.

Miscellaneous Questions to exercise the foregoing Cases.

1. What is the interest of dols. 926,28, for a year, at 4 per cent. per annum? Ans. dols. 37,45,1$\frac{2}{10}$.

2. What is the interest of dols. 371,85, for a year, at 5 per cent. per annum. Ans. dols. 18,59,2$\frac{1}{2}$.

3. What is the interest of dols. 36,26, for 4 years, 11 months, and 6 days, at 5$\frac{1}{4}$ per cent. per annum? Ans. dols. 9.39,1$\frac{34}{100}$.

4. What is the interest of dols. 561,29 for 9 weeks, at 4$\frac{1}{2}$ per cent. per annum? Ans. dols. 4,37,1+

5. What principal being put to interest 9 years, at 6 per cent. per annum, will amount to 770 dols.? Ans. 500 dols.

6. At what rate per cent will 500 dols. amount to 770 dols. in 9 years? Ans. 6 per cent.

7. In what time will 500 dols. amount to 770 dols. at 6 per cent. per annum? Ans. 9 years.

8. In what time will 1 cent amount to 600 dols. at 6 per cent. per annum? Ans. 10000 years.

9. A gentleman had a daughter married on the day she was 18 years old, to whom he gave a note dated on the day she was born, and amounted then to 5200 dols. at 6 per cent. per annum, how much was the principal?
Ans. 2500 dols.

10. What is the amount of a cent, for 1809 years, at 6 per cent. per annum? Ans. dols. 108,55.

COMPOUND INTEREST.

Compound Interest is an allowance for the forbearance of the principal and interest taken together, i. e. when the interest is not paid at the stipulated time, it is added to the principal, and their sum becomes a new principal, &c.

To find the compound interest of a sum for several years.

Rule. Calculate the interest for 1 year, as in the first case of Simple Interest; add this interest and its principal together, which is the principal for the second year; calculate its interest as above, and add this interest, to its principal, their sum will be the principal for the third year.

Go through as many such calculations as there are year's interest required; add the last interest found to its principal, their sum will be the whole amount of principal and interest; from the amount subtract the first principal given, the difference will be the whole interest required.

Examples.

1 What is the amount of £726 11 6, for 3 years, at 6 per cent. per annum, Compound Interest?

£736 11 6 Principal for 1st year.
6

44	19 9 0	
	20	
3	89	
	12	
10	68	
	4	
2	72	

£44 3 10½ 1 year's interest.
736 11 6 principal for 1st year.

780 15 4½ principal for 2d year.
6

46	84 12 3	
	20	
16	92	
	12	
11	07	

£46 16 11 2d year's interest.
780 15 4½ principal for 2d year.

827 12 3½ principal for 3d year.
6

49	65 13 9	
	20	
13	13	
	12	
1	65	
	4	
2	60	

£49 13 1½ 3d year's interest.
827 12 3½ principal for 3d year.

£877 5 5 Amount, Ans.

2. Required the compound interest of dols. 725,50, for 2 years, at 6 per cent. per annum.

$725,50	principal for 1st. year.
6	
43,53,00	1st year's interest.
725,50	principal for 1st year.
769,03	principal for 2d year.
6	
46,14,1,8	2d year's interest.
769,03	principal for 2d year.
815,17,1,8	amount for 2 years.
725,50	principal for 1st year.

Ans. $89,67,1,8 Compound Interest for 2 years.

3. What is the compound interest of 680 dols. for 4 years, at 6 per cent. per annum? Ans. $178,48,3.

4. What is the compound interest of dols. 637,25, for 5 years, at 5 per cent. per annum?

Ans. 176,06.

5. What is the amount of dols. 597,75 for 20 years, at 6 per cent. per annum, compound interest?

Ans. dols. 1917,07,7.

6. What will 1350 dols. amount to in 3 years, at 5 per cent. per annum, compound interest?

Ans. dols. 1562,79,3.

BARTER.

Barter is the exchanging one kind of goods for another without loss or gain to either party; questions in this rule are solved by finding what quantity of one kind of goods, at a given price, is equal in value to a given quantity of another kind, the price of the latter also being given.

Questions of this kind are proved by varying their order.

Examples.

1. How much sugar at 9d. per lb. must be given in barter for $6\frac{1}{2}$ cwt. of tobacco, at 14d. per lb?

cwt. 6 2
4
26
28
208
52
728
14
2912
728
10192

9 : 1 :: 10192

9)
4)
28)1132$\frac{4}{9}$(40
112
10C. 0qr. 12$\frac{4}{9}$ Ans.
12

2. How much tobacco at 14d. per lb. must be given in barter for 10C. 0qr. 12$\frac{4}{9}$ lb. of sugar, at 9d. per lb?

cwt. 10 0 12$\frac{4}{9}$
4
40
28
1132
9
10192

14 : 1 :: 10192

14) 28) 4)
98 56 —
— — 6$\frac{1}{2}$C. Ans.
39 168
28 168
112
112

This proves the first example.

3. What quantity of tea at $1,20 per lb. must be given in barter for 1 cwt. of chocolate, at 32 cents per lb? Ans. 29$\frac{4}{12}$ lb.

4. How much rice at 28s. per cwt. must be given in barter for 3$\frac{1}{2}$ cwt. of raisins at 5d. per lb? Ans. 5C. 3qrs. 9$\frac{11}{33}$lb.

5. A man bought a lot of goods, for which he gave 1000 dols. in money, and 5 cwt. of tobacco, at 10 cents per lb.; what was the value of the lot of goods?

Ans. 1056 dols.

6. A man bought a lot of goods, for which he gave 12cwt. of tobacco, at 15 cents per lb. 24 cwt. of sugar, at 12 cents per lb. and paid the remainder in money; the whole value of the goods was 9000 dols. how much money did he pay? Ans. $8475,84.

7. A merchant bartered 7 cwt. of rice, at 28s. per cwt. for 4 cwt. of raisins, at 6d. per lb. and paid the balance in money, how much money did he pay?

Ans. £1 8.

8. A merchant delivered 3 hogsheads of wine, at $1,10 per gallon, for 126 yards of cloth; what was the cloth per yard? Ans. $1,65.

9. A and B bartered: A had 12 cwt. of sugar worth 8 cents per lb. for which B gave him $1\frac{1}{4}$ cwt. of cinnamon; what did B value his cinnamon at per lb?

Ans. 54 cents, and $\frac{168}{196}$.

10. A has linen cloth worth 40 cents ready money, but in barter he will have 48 cents per yard; B has broadcloth worth 2 dols. per yard, in ready money, which he is minded to barter with A for his linen, what ought the broadcloth to be per yard, in barter for the linen? Ans. dols. 2,40.

11. A had 41 cwt. of hops at dols. 6,70 per cwt. for which B gave him 17 C. 3 qrs. 4 lb. of prunes, and 88 dols.; what was the prunes valued at per lb?

Ans. cts. $9\frac{742}{1960}$.

12. A has candles worth 12 cents per lb. ready money, but in barter he will have 13 cents; B has cotton worth 18 cents per lb. ready money; what ought the cotton to be per lb. in barter, and how much must be given of the cotton for 1200lb. of the candles?

Ans. { The cotton must be in barter $19\frac{1}{2}$ cents, and 7C. 0qr. 16lb. must be given for 1200lb. of candles.

LOSS AND GAIN.

Loss and Gain is a rule, which teaches how to find what is lost or gained in buying and selling a lot of goods, by comparing the prices, they are bought and sold at, together.

Note 1. *If the gain or loss per cent is required, say, as the whole sum paid or bought for, is to the difference between that and the whole sold for, so is* 100 *to the gain or loss per cent.*

Note 2. *To fix a price on goods, in order to gain or lose a certain rate per cent, say, as* 100 *is to the price the goods cost, so is* 100 *with the gain per cent added, or loss per cent subtracted, to the price for which they must be sold, to gain or lose the proposed rate per cent.*

Note 3. *When the intended sum to be gained, or lost, is given, in order to know how to sell, so as to gain or lose that sum, say, as the first cost is to the first cost with the proposed gain added, or the proposed loss subtracted, so is the first cost of* 1 *yard, pound, &c. to the price* 1 *yard, or* 1 *pound, &c. must be sold at.*

Examples.

1. A man bought a barrel of cider for 28s. which he sold for 3d. a quart, it contained 32 gallons; did he gain or lose, and how much?

32 gal.
4
---
128 qts.
3 d.
---
12)384
---
sold for 32s.
bought for 28
---
gained 4s. Ans.

2. If a man sell a barrel of cider containing 32 gallons, for 3d. a quart, and gain 4s. how much did it cost him?

32
4

128
3
---
12)384
---
sold for 32s.
gained 4s.
---
cost 28s. Ans.

3. Bought 1525 gallons of rum, which proving of a bad quality, I sold the whole together for 1560 dols.; the first cost was $1,12½ per gallon; did I lose or gain, and how much? Ans. lost dols. 215,62½.

4. A man bought 100 yards of cloth for 300 dols. I demand how he must sell it per yard, to gain 25 per cent? Ans. dols. 3,75.

5. Bought 900 gallons of brandy for 925 dols. which I sold at 1 dol. per gallon, what did I gain or lose? Ans. lost 25 dols.

6. Bought 100 yards of cloth at 2 dols. per yard, how must I sell it per yard to gain 50 dols? Ans. $2,50.

7. Bought 100 yards of cloth for 300 dols. and sold it at 25 per cent. loss; how did I sell it per yard? Ans. dols. 2,25.

8. Shipped for the West Indies 150000 feet of boards, at 7 dols. per thousand; 40 thousand pipe staves at 16 dols. per thousand; 60 thousand barrel staves at 8 dols. per thousand; 2000 quintals of cod-fish at 3 dols. per quintal, paid charges of shipping, $60,75, freight $500,27; for which I received in return 40 hogsheads of rum, containing 116 gallons each, (when shipped,) but gauged only 112 gallons each, on an average, when it arrived; 40 hogsheads of molasses, 122 gallons each, when shipped; but gauged on an average 118¼ gallons when it was landed; 40 hogsheads of sugar weighing 11 cwt. 2 qrs. 16 lb. each; charges of shipping at West Indies $16,30, freight 400 dols. cooperage $20,62½, gauger's bill $6,40; I sold the rum at dol. 1,12½ per gallon, the

molasses at 30 cents per gallon, the sugar (which fell short in the whole weight 3C. 1qr. 24lb.) at 10 dols. per cwt; how much was the gain or loss on this adventure; also how much difference would there have been, had the measure and weight been the same at selling, as was bought; and how much was lost per cent, by the deficiency of measure and weight?

Ans. { Real gain, $1910,15,5
Had weight and measure been as shipped it would have the gain more by } 172
Which would have made the whole gain, } 2082,15,5
The loss per cent was by short weight, &c. rejecting remainders, } 1,87+

9. Sent to India 50000 dols. in specie; my correspondent sent it to Kamtchatka, and purchased furs, which when sold in Canton, the net proceeds, after deducting all charges, was 100000 dols. which he sent in teas; by the ship's leaking, the teas were damaged, so that after paying $500 expenses in landing, drying, &c. the whole was sold for dols. 42436,25; how much was gained or lost by the adventure? Ans. lost $8063,75.

10. Sent lumber to the West Indies; in a storm part was thrown overboard, by which ten per cent was lost; for the remainder I had shipped there, 18000 gallons of rum, at 50 cents per gallon; which by leakage, lost ten per cent; the duties paid on what arrived, was 25 cents per gallon; the truckage cost 25 dols. gauger's bill $14,50; I demand how I must sell this rum per gallon, so as to gain 25 per cent. on the whole value of the lumber sent, and the money paid.

Ans. $1,12,2$\frac{7977}{18200}$.

SIMPLE FELLOWSHIP.

Simple or Single Fellowship is that by which each partner's share of profit or loss is found, when their several shares of stock have been continued in trade, an equal term of time.

To find each partner's share of the gain or loss, say, as the sum of all the shares of the stock is to the whole gain or loss, so is each partner's share of the stock, to his share of the gain or loss.

To prove the work, add all the shares of the gain or loss together, the sum will be equal to the whole gain or loss; or thus, as the whole gain or loss is to the whole sum of all the shares of the stock, so is each partner's share of the gain or loss, to his share of the stock.

Note. This rule is applicable to many purposes, as proportioning estates of insolvent debtors among their creditors; legacies among heirs, when the estate falls short of the bequest, &c.

Examples.

1. A and B purchased a lot of goods together, for which A paid 250 dols. B 500 dols.; after selling them, they found they had gained 375 dols.; what was each man's share of the gain?

A paid 250
B 500

750 : 375 :: 250
250

18750
750

750)93750(125
750

1875
1500

3750
3750

750 : 375 :: 500
500

750)18750(250
150

375
375

0

A's gain, 125
B's 250

proof, 375

2. A, B, and C trade in company; A put into the stock 1500 dols. B put in 2000 dols. and C 1800; at the end of the year, they dissolved partnership, and had gained 1000 dols. what was each man's share of the gain, and how much must he receive of the company?

1500 5300 : 1000 :: 1500 5300 : 1000 :: 2000
2000 1500 2000
1800
5300 53|00)15000|00(283,01$\frac{47}{53}$ 53|00)20000|00(377,35$\frac{45}{53}$
106 159
440 410
424 371
160 390
159 371
100 190
53 159
47 310
265
45

5300 : 1000 :: 1800
1800
53|00)18000|00(339,62$\frac{14}{53}$
159
210
159
510
477
330
318
120
106
14

whole stock $5300
whole gain 1000
whole to divide 6300

A's gain $283,01$\frac{47}{53}$
B's 377,35$\frac{45}{53}$
C's 339,62$\frac{14}{53}$

Proof, =1000,00
to A's sto. $1500
add his gain 283,01$\frac{47}{53}$
A receiv. of the com. 1783,01$\frac{47}{53}$
to B's stock $2000
add his gain 377,35$\frac{45}{53}$
B receiv. of the com. 2377,35$\frac{45}{53}$
to C's stock $1800
add his gain 339,62$\frac{14}{53}$
C receiv. of the com. 2139,62$\frac{14}{53}$
proof $6300,00

3. A, B and C trade in company; A put into stock 250 dols. B put in 300 dols. and C 550 dols. and lost 5 per cent. by trading; what was each man's share of the loss?

Ans. { A's share of the loss, $12,50
B's 15,00
C's 27,50

4. A, B and C trade in company; A put in 500 dols. B $350, and C put in 120 yards of cloth; they gained dols. 332,50, of which C's share was 120 dols. what was A's and B's shares of the gain, and the value of C's cloth per yard?

Ans. { A's share of the gain dols. 125
B's 87,50
C's cloth per yard, 4

5. A, B and C trade in company; A put in 2000 dols. B put in 20 hogsheads of rum, and C 500 barrels of flour; they gained 650 dols. of which B's share was 200 dols. C's 250 dols. I demand A's share of the gain, and the value of B's rum, and C's flour?

Ans. { A's share of the gain, dols. 200
Value of B's rum, 2000
Value of C's flour, 2500

6. A, B and C trade in company; A put in 3000 dols. B 3500 dols. and C 4500: they gained 30 per cent, but received the whole amount of their goods in bills, for which they were obliged to allow a discount of ten per cent. or suffer a loss on them of ten per cent; how much was each man's net gain?

Ans. { A's net gain was dols. 810
B's 945
C's 1215

7. A merchant by will left to his children his estate, as follows, to A he bequeathed 5000 dols. to B 4500 dols. to C 4500 dols. and to D 4000 dols. But his whole estate, after paying debts, charges, &c. amounted to but 12000 dols.; what must each have?

Ans. { A dols. 3333,33⅓
B 3000
C 3000
D 2666,66⅔

8. A, B, and C bought a ship, for which A paid $3855, B paid $2977,50, and C $1752,50; they gain by her earnings, $3434; what is each man's share of the gain?

Ans. { A dols. 1542
B 1191
C 701

9. A sent to a correspondent in Martinique, goods to the amo unt of 540 dols. to which B, his correspondent, added goods to an amount unknown to A, and sent the whole to another port, by which the whole gain was 387 dols. of which B took 225 dols. for his share: Please to inform A what his stock and gains together is, and the value of what B put in?

Ans. { A's stock and gain together is dols. 702
B's share of stock, 750

10. A put into an adventure, or voyage, 2850 dols. B put in 1980 dols. and C put in the remainder, which made the whole 8000 dols; by shipwreck they lost 6400 dols.; how much must each sustain of the loss?

Ans. { A's loss, dols. 2280
B's 1584
C's 2536

COMPOUND FELLOWSHIP.

Compound or Double Fellowship, is when the several shares of the stock in trade are continued in trade unequal times.

To find each partner's share of the gain or loss.

Rule. Multiply each man's share of the stock, by the time it was continued in trade, and add the several products together; then say, as the sum of all the products is to the whole gain or loss, so is the product of each man's stock and time, to his share of the gain or loss.

EXAMPLES.

1. Two merchants trade in company; A put in 5000 dols. for 9 months, B put in 4000 dols. for 6 months; they gained 690 dols.; how much is each man's share of the gain?

A 5000 B 4000
9 6

45000 24000
24000

69000 : 690 :: 45000
45000

345
276

69|000)31050|000(450 A.
276

345
345

69000 : 690 :: 24000
24000

276
138

69|000)16560|000(240
138

276
276

Ans. { A 450
B 240

proof, 690

2. A. B and C trade in company; A put in $3000 for 6 months, B $4000 for 10 months, and C $2500 for 12 months, they gained $880; how much is each man's share of the gain?

Ans. { A $180
B 400
C 300

3. A and B trade in Company, A put in $3000, and at the end of 6 months, put in $2000 more; B put in $6000, and at the end of 8 months, took out $3000; they trade one year, and gain 1080 dols.; how much must each man have of the gain?

Ans. { A, $480
B, 600

4. A put into stock in company, 4000 dols. for 9 months; B put in 3000 dols. for 6 months, C put in 2000 dols. for 5 months; they gained 3200 dols. what is each man's share of the gain?

Ans. { A, $1800
B, 900
C, 500

5. A, B and C trade in company; A put in 5000 dols. for 18 months, B 3800 dols. for 13 months, and C 2700 dols. for 9 months; they gained 818 dols; what was each man's share of the gain?

Ans { A, dols. 447,25 $\frac{175}{1637}$
B, 246,49 $\frac{187}{1637}$
C, 121,25 $\frac{1275}{1637}$

6. A, B and C traded in company as follows: On the first of January, A put in 3800 dols. on the first of May following, B put in 2700 dols. and on the first of August following, C put in 4000 dols; at the end of the year, they dissolved partnership, each took his share of stock and gain, the whole gain being 4360 dols. how much did each take?

Ans. { A took for stock and gain, $6133 $\frac{444}{855}$
B, 3703 $\frac{4}{855}$
C, 5023 $\frac{404}{855}$

7. A and B trade in company for 1 year only; on the first of January, A put in 1200 dols. but B could not put any money into the stock till the first of April; how much must B put in, so as to share equally with A?

Ans. 1600 dols.

TARE AND TRET.

Tare is an allowance made for the weight of the box, cask, bale, or whatever contains the goods, and is either,

1. At so much per bag, barrel, hogshead, box, &c.
2. At so much per cent; or,
3. At so much in the whole gross weight, called invoice tare.

So much per cent in Avoirdupois weight, is always to be understood so much for 112 pounds, that being one hundred of that weight.

Tret is an allowance made to the buyer of 4 pounds in 104 pounds, which is a twenty sixth part of the whole, for waste and dust, in some sorts of goods.

Gloff is sometimes allowed, which is 2 pounds on each draught of more than 3 cwt.

Gross weight is the whole weight of the goods, and of the box, bag, or whatever contains them.

Net weight is the pure weight of the goods, after all allowances are made.

The following are the usual allowances for tare in England, as in a book of rates.

For Cyprus and Smyrna silk.

Bales	about or above 300 lb.	The tare per bale is	16 lb.
	from 300 to 200 lb.		14 lb.
	from 200lb. downwards.		12 lb.

Virginia tobacco.

Hhds.	5 cwt. and upwards.	The tare per hhd. is	100 lb.
	from 5 to 4 cwt.		90 lb.
	from 4 to 3 cwt.		80 lb.
	under 3 cwt.		70 lb.

Sugar from India.

In casks and cannisters.	Tare 1,6th.
In chest and casks from St. Thomas'.	1,5th.

Oil from Canada, 29lb. per barrel.

In the United States' custom-houses on tea, coffee, and sugar.

Tare on bohea tea.	whole chests.	each 70lb.
	half do.	36lb.
	quarter do.	20lb.
green teas.	Chest of 70lb. and upwards gross.	each 20 lb.
Boxes of other teas, including ropes and coverings.	from 50 to 70 lb. gross,	each 18 lb.
	of 80 lb. gross,	20 lb.
	from 80lb. gross, and upwards,	22 lb.

Tare on boxes of other dimensions, according to invoice or weight.

Tare for coffee. { in casks 12 lb. / bales, 3 lb. / bags, 2 lb. } per 100 lb.

Sugar other than loaf. { in bags, or mats, 5lb. / casks, 12lb. / boxes, 15lb. } per 100 lb.

CASE I. When the quantity is given in cwt. &c. and the tare is not an aliquot part of a cwt. nor so much per cent.

Find the whole gross weight in cwt. &c; also find the whole tare in cwt. &c. and subtract the tare from the gross, the remainder will be the net weight.

EXAMPLES.

1. In 16 hogsheads of tobacco, each 5 cwt. 1 qr. 19lb. gross, tare per hogshead 100lb. how much net weight?

	C.	qr.	lb.
	5	1	19
			4
	21	2	20
			4
Whole gross,	86	2	24
Whole tare,	14	1	4
Net	72	1	20 Ans.

100
16
4)
28)1600 (57
140
14 1 4
200
196
4

2. In 14 hogsheads of tobacco, weighing gross, 89 C. 3 qr. 17 lb. tare per hogshead, 100 lb. how much net weight? Ans. 77C. 1qr. 17lb.

3. What is the net weight of 38 hogsheads of tobacco, weighing gross 201 cwt. 3 qr. 12 lb. tare in the whole 3140 lb. Ans. 173 cwt. 3 qrs. 8 lb.

4. What is the net weight of 5 hogsheads of sugar, weighing as follows, viz?

Gross				Tare	
No. 1=	9C.	3qr.	17lb.		90lb.
2=10	1		12		95
3=11	0		20		100
whole gross	31	1	21		
whole tare,	2	2	5		
net,	28	3	16 Ans.		

4)
28)285(10
28
2 2 5
5

CASE II. When the quantity is given in cwt. the tare so much per cent. and is an aliquot part or parts of an cwt.

Divide the whole gross weight by such part or parts, that the tare is of an cwt. the quotient will be the whole tare, which subtracted from the whole gross, the remainder will be the net weight.

EXAMPLES.

1. What is the net weight of a hogshead of sugar, weighing gross 9 C. 3 qrs. 14lb. tare 14lb. per cent?

14 lb. is $\frac{1}{8}$ of an cwt. 8)9C. 3qr. 14lb. gross.
1 0 $26\frac{1}{4}$ tare.

Ans. 8 2 $15\frac{3}{4}$ net.

2. Required the net weight of 2 hogsheads of sugar, weighing together gross, 15C. 3qr. 18lb; tare per cent. 18lb.

16lb. is $\frac{1}{7}$ of cwt. 7 | 15C. 3qrs. 18lb. gross.

2lb. is $\frac{1}{8}$ of 16lb. 8 | 2 1 2, 9 } these two lines must
0 1 3,13 } be added together.

2 2 6,6 tare.

Ans. 13C. 1qr. 11lb. 10oz. net.

3. Required the net weight of 41C. 3qr. 9lb. gross of hops, tare per cent 20lb.* Ans. 34C. 1qr. 12lb. 7oz.

CASE III. When the quantity is given in cwt. &c. the tare so much per cent, but not an aliquot part, or parts of an cwt. then multiply the pounds gross by the tare per cent, and divide the product by 112, the quotient will be the tare, which subtracted from the gross, the remainder will be the net weight.

EXAMPLES.

1. What is the net weight of 30 barrels of figs, each 2C. 3 qr. gross, tare per cent 13lb?

* This can be worked by taking parts, thus, 16lb. is $\frac{1}{7}$ of cwt. and the 4lb. remaining of the 20lb. is $\frac{1}{4}$ of 16lb.

cwt. 2 3 qrs.
4
11
28
308
30

whole gross, 9240lb.
whole tare, 1072 8 oz.

28)8167 8 (291
56
256
252
47
28
19lb.

9240
12
27720
9240
112)120120(1072 8
112
812
784
280
224
56
16
336
56
896
896

72C. 3 qr.

Ans. 72C. 3qr. 19lb. 8oz.

2. What is the net weight of 12 barrels of argol, each weighing gross 4C. 0qr. 8lb ; tare per cent 15lb ?

Ans. 42C. 1 qr. 7lb. 3 oz.

3. What is the net weight of 12 butts of currants, each weighing 7C. 1 qr. 10lb. gross ; tare per cent 15lb ? Ans. 76C. 1qr. 2lb. 15oz.

Case IV. When the quantity is given in casks, bags, bales, or boxes, with their several gross weight in pounds, and the tare of each in pounds.

Find the whole gross weight in pounds, also find the whole tare in pounds ; subtract the whole tare from the whole gross, the remainder will be the net weight in pounds.

Examples.

1. What is the net weight of 3 chests of hyson tea, weighing as follows :

No. 1, 90lb.
2, 98
3, 103
} gross ; tare per chest, 20lb. 3

whole gross, 291 whole tare 60
whole tare 60

net, 231 lb. Ans.

2. What is the net weight of 3 boxes of souchong tea, weighing as follows, viz. ?

No. 1, 65lb.
2, 74lb.
3, 86lb.
} gross ; tare, { 18lb. 20 22

Ans. 165lb.

Case V. When tret is allowed ; after subtracting the tare from the gross weight, reduce the remainder to pounds, which is called pounds suttle, and divide by 26, the quotient will be the tret, which subtract from the suttle, the remainder will be the net weight in pounds.

Examples.

1. In 8C. 3qr. 20lb. gross, tare 38lb. tret 4lb. per 104lb. how many pounds net.

8C. 3qr. 20lb.
4
35
28
300
70

Gross, 1000lb.
Tare, 38

Suttle, 962
Tret, 37

Net, 925 Ans.

26)962(37 tret.
78
182
182

2. In 17 chests of sugar, weighing together 120 C. 2qr. gross, tare 176lb. tret 4lb. per 104lb. how many cwt. net? Ans. 114C. 1qr. 12lb.

3. In 177C. 0qr. 22lb. gross, tare 9lb. per cent, tret 4lb. per 104lb. how many cwt. net?

Ans. 156C. 2qr. 22lb. rejecting remainders.

CASE VI. When the net weight is given, and the gross weight required; this admits of three varieties.

1. When the net weight, and whole tare is given, add the tare to the net, gives the gross.

2. When the net weight, and the tare per cent are given, subtract the tare per cent, from 112lb. then say, as the remaining number of pounds is to 112 pounds, so is the given net weight in pounds, to the required gross weight in pounds.

3. When the net weight, and the tare are given, and tret has been allowed.

Divide the pounds net by 25, and add the quotient to the pounds net, and then proceed as in the 1st or 2d variety, as the case may require, to find the gross.

EXAMPLES.

1. What is the gross weight of 38 hogsheads of tobacco, which contains 173C. 3 qr. 8lb. net, the whole tare being 3140lb?

Net,	173C.	3qr.	8lb.	
Tare,	28	0	4	
Gross,	201	3	12	Ans.

28)3140(112
28
—
34
28
—
60
56
—
4

4)
—
28

NOTE. This proves the 3d example in Case I.

2. What is the gross weight of a hogshead of sugar, weighing 8C. 2qrs. 15¼lb. net; tare 14lb. per cent?

112lb. 8 2 15 75
14 4
98lb. : 112lb. :: 967,75 34
112 28
193550 287
1064525 68
28) (4
98)108388 00(1106(39 967 75
98 84
103 266
98 252
588 14
588

9C. 3qr. 14lb. Ans.

Note. This proves the 1st example in the second case.

3. What is the gross weight of a lot of goods, weighing 925lb. net, having tret allowed, and the whole tare was 38lb. ?

25)925(37 925 28)1000(35 (4
75 37 84
175 suttle, 962lb. 160 8C. 3qr. 20lb. Ans.
175 whole tare, 38 140
1000 20

Note. This proves the first example in the fifth case.

Examples with prices.

1. Bought a hogshead of sugar weighing gross, 9C. 1qr. tare 12lb. per cent, for 10 cents per lb. and sold it so as to gain $46,25 ; how much did I pay for the whole, how much did I receive for the whole, and how did I sell it per cwt. and also per lb ?

Ans. Paid $92,50.
Received 138,75.
Sold at, 16,80 per cwt.
1,5 per lb.

2. What is the value of a hogshead of tobacco, weighing 5C. 3qrs. 16lb. gross; tare 100lb. at $16,80 per cwt. Ans. $88,20.

3. Admit a hogshead of tobacco be bought at 15 cents per lb. and sold at 20 cents per lb. and the gross weight was 6 cwt. tare 100lb. tret 4 lb. per 104 lb. how much did it cost, how much did it sell for, and what was the gain?

Ans. { Cost, $82,50 / Sold for 110,00 / Gain, 27,50 }

4. Bought a chest of hyson tea, at 85 cents per lb. weighing gross 75lb. tare 20lb. how much did it cost me, and how must I sell it per lb. to gain $8,25, by the bargain?

Ans. { Cost $46,75. / Must be sold at 1, per lb. }

5. What is the value of 5 chests of hyson tea, weighing as follows, viz.

No. { 1 - 70lb. / 2 - 72 / 3 - 75 / 4 - 73 / 5 - 71 } gross; tare per chest 20lb. at 63 cents per lb.; and how must it be sold per lb. to gain $83,52?

Ans. { Value at 63 cents per lb. $154,43. / Must be sold at 95 cents per lb. }

6. A hogshead of tobacco weighing 6cwt. gross, tare 100lb. tret 4lb. per 104lb. was bought at 15 cents per lb. and sold so as to gain $27,50; what did the whole cost, and what was it sold at per lb?

Ans. { Cost $82,50. / Sold at 20 cents, per lb. }

7. Bought a chest of hyson tea, which I sold again, and gained $8,25, the price bought at, bore such proportion to that sold at, as 170 bears to 200; what did it cost, and what was it sold at per lb. the chest weighing gross 75lb. tare 20lb?

Ans. { It cost 85 cents, / Sold at $1,00 } per lb.

COMMISSION.

Commission is an allowance to agents, who transact business for others, in buying, selling, &c. and is a certain rate per cent, on the value of the goods bought or sold, &c.

The same rule applies here as in finding the interest for one year, having the principal and rate per cent. given.

EXAMPLES.

1. My factor writes me that he has bought goods for me to the value of £500 13 6; I demand what his commission comes to, at 3½ per cent?

(2
£500 13 6
3½

1502 0 6
250 6 9

17|52 7 3
20
10|47
12
5|67
4
2|68

Ans. £17 10 5½ 68/100.

2. My correspondent in London has disbursed for me the sum of £1009 18; what is his commission at 2½ per cent in sterling money? Ans. £22 14 5¼ 84/100.

3. My factor writes me that he has disposed of goods for me, to the amount of $9000; how much is his commission at 5 per cent? Ans. $450.

4. What is the commission on $797,25, at 3¼ per cent? Ans. $29,89,6 ,875.

NOTE. Questions in this rule may be proved by varying their order. See the first example varied.

5. If my factor received £17 10 $5\frac{1}{2}\frac{68}{100}$, by an allowance of $3\frac{1}{2}$ per cent; what was the sum he disbursed?

£3 10 :: £100 :: £17 10 $5\frac{1}{2}\frac{68}{100}$

20	20	3360|00)1682268|00(500 136	£
		16800	Ans.
70	350		
12	12	2268	
		20	
840	4205		
4	4	45360(13	
		3360	
386000	1682268		
	100	11760	
		10080	
	168226800		
		1680	
		12	
		20160(6	
		20160	

ENSURANCE.

Ensurance is an exemption from hazard, obtained by the payment of a certain sum, which is generally so much per cent. on the amount of the property ensured.

The amount ensured is called the principal.

The money paid for ensuring is called the premium.

Note. The premium is found when the amount ensured, and rate are given; in the same manner as commission is found.

Examples.

1. What must I pay for ensuring a ship and cargo, valued at $56000 at $2\frac{1}{2}$ per cent?

2)56000
$2\frac{1}{2}$

112000	
28000	Ans. $1400.
1400|00	

2. What must be paid for ensuring $9368, at $1\frac{1}{4}$ per cent? Ans. $140,37.

When it is required to ensure a sum sufficient to cover both principal and premium, the principal and rate given.

Subtract the rate from 100, then say, as the remaining sum is to 100, so is the given principal to the sum required.

3. My ship and cargo is valued at $64000; what sum must I ensure to cover both principal and premium, when I pay $2\frac{1}{2}$ per cent. for ensurance?

$100 97,50 : 100 :: 64000
2,50 250
97,50 9750

9750)6400000(65641,02,5+
5850
5500
4875
6250
5850
4000
3900
1000
975
2500
1950
5500
4875
625

Ans. $65641,02,5 +

Proof. 2)65641,02,5
$2\frac{1}{2}$
131282,05,0
32820,51,25

Premium to subtract, 1641,02,5,6,25
From sum ensured, 65641,02,5
Remains first sum nearly, 63999,99,9,3,75

Note. This proof falls short of the first sum given by $\frac{625}{1000}$ *of a mill, owing to the remaining fraction in the of-*

eration for finding the sum to ensure, being omitted in this.

4. I have shipped goods to the value of $9165,60, how much must I ensure to cover both principal and premium, when I pay 5 per cent? Ans. $9648.

5. What must be paid for ensuring $4630, at 7½ per cent? Ans. $347,25.

6. I shipped goods and ensured $6000, which covered principal and premium, and paid 5 per cent; what was the value of the goods? Ans. $5700.

Note. The value of the goods is found by finding the premium for $6000 at 5 per cent. and subtract the premium thus found, from the sum it was found for.

7. A merchant shipped goods to the amount of $4000, paid charges of shipping $60, freight he is to pay $100, the duties at the foreign port he expects will be $50, he ensures the whole at 5½ per cent; how much does he pay for ensurance? Ans. $231,25.

BROKERAGE.

Brokerage is the pay or reward of a broker, who procures a market for goods, &c. and is sometimes so much per cent. on the amount of the goods sold by their assistance; sometimes so many shillings per cent, or rather so many shillings on every 100 pounds, which is meant when expressed, so many shillings per cent; sometimes it is expressed so many cents per cent. which is understood so many cents on every 100 dollars, &c.

Note. Questions in this rule are proved by varying their order. See the second example varied for proof.

Case I. When the brokerage is so much per cent. as 1 per cent, 5 per cent, &c. proceed as in finding the commission.

Examples.

1. A broker has procured the sale of goods for me, to the amount of $2563,25; what will his brokerage come to at 1½ per cent? Ans. $38,44,8, 75.

2. My broker has procured the sale of goods for me to the amount of $7369,46 ; what will his brokerage come to at ½ per cent ? Ans. $36,84,7 ,3.

To prove this.

3. If I pay a broker $36,84,7,3, and allowed him ½ per cent. to what amount did he find sale for me ?

36,84,7,3
2

Ans. $7369,46

CASE II. When the brokerage is so many shillings &c. per cent.

RULE. Divide the given sum by 100, and then take parts of the quotient with the rate per cent.

EXAMPLES.

1. What will the brokerage for £7364 11 6 come to at 4s. 6d. per cent ?

£73	64 11 6	4s.	⅕	73 12 10¼	
	20				
	—	6d.	⅛	14 14 6¾	
12	91			1 16 9¾	
	12				
	—	A.		£16 11 4½	rejecting
10	98				remainders.
	4				
	—				
3	92				

2. What is the brokerage for £700 14 6, at 4s. per cent ? Ans. £1 8 0¼.

3. What is the brokerage for £500 10 7, at 7s. per cent ? Ans. £1 15 0¼.

4. What is the brokerage for £909 14 10, at 6s. 6d. per cent ? Ans. £2 19 1¼.

CASE III. When the brokerage is so many cents per cent.

In this case are four varieties.

Variety 1. When the given sum is dollars only.

RULE. Multiply the given sum by the cents per cent, and point off four places of right hand figures, those at the

left of the point will be dollars, the next two figures at the right of the point, are cents, the next figure a mill, or mills, &c.

EXAMPLES.

1. What is the brokerage for $7364, at 36 cents per cent?

7364
36
44184
22092
Ans. $26,51,0,4

36)26,51,0,4($7364 proof.
252
131
108
230
216
144
144

2. What is the brokerage of $9643, at 75 cents per cent? Ans. $72,32,2,5.

3. A broker has sold goods for me, to the amount of $17630; what must I pay him, allowing 80 cents per cent? Ans. $141,04.

Var. 2. When the given sum is dollars and cents.

RULE. Multiply as in the first variety, and point off six right hand figures, all at the left of the point will be dollars, &c. as before.

EXAMPLES.

1. Required the brokerage for $9642,36, at 47 cents per cent.

9642,36
47
6749652
3856944
Ans. $55,31,9,092

2. A broker has procured the sale of goods for me, to the amount of $11637,75; what may he demand when I allow him 55 cents per cent?

Ans. $64,00,7 ,625.

Var. 3. When the given sum is dollars, cents, and mills.

Rule. Multiply by the cents as before, and point off seven places of right hand figures, those at the left of the point will be dollars, &c.

Examples.

1. What is the brokerage for $9375,23,7, at 73 cents per cent? Ans. $68,43,9 ,2301.

2. Required the brokerage for $1637,27,9, at 48 cents per cent. Ans. $7,85,8 ,9392.

Var. 4. When the brokerage is cents and mills.

Rule. Multiply the given sum by the given cents and mills, and if the given sum be dollars, point off five right hand figures.

If dollars and cents, point off seven.

If dollars cents and mills, point off eight of the right hand figures, those at the left of the point will be dollars, the next two at the right of the point will be cents, the next one, a mill or mills.

Examples.

1. What is the brokerage for $9364, at 57 cents, 7 mills per cent?

9364
57,7

65548
65548
46820

Ans. dols. 54,03,0,28

2. What is the brokerage for dols. 7367,25, at 75 cents, 5 mills? Ans. dols. 55,62,2 ,7375.

3. What is the brokerage for dols. 11963,21,7, at 48 cents, 5 mills per cent? Ans. dols. 58,02,1 ,60245.

EQUATION OF PAYMENTS.

When several sums of money to be paid at different times, are reduced to one mean time for the payment of the whole, without loss or gain to the debtor or creditor; this is called Equation of Payments.

To find the mean or equated time.

RULE. Multiply each payment by its time, add all the products together, and divide their sum by the whole debt; the quotient will be the equated time.

EXAMPLES.

1. A owes B 100 dols. whereof 50 dols. are to be paid at 2 months, and 50 dols. at 4 months; but they agreed to reduce them to one payment; when must the whole be paid?

50	50
2	4
100	200

200

100)300

Ans. at 3 months.

2. A merchant has owing to him 300 dols. which is to be paid as follows, viz. 50 dols. at 2 months, 100 dols. at 5 months, and the remainder at 8 months; and it is agreed to make one payment of the whole: The time is required. Ans. 6 months.

3. A man owes 1000 dols. whereof 200 dols. are to be paid at the present time, 400 dols. at 5 months, and the remainder at 10 months; but it is agreed to make one payment of the whole. Required the equated time. Ans. 6 months.

4. A man owes a certain sum of money* which is to be paid at four equal payments, viz. at 2 months, at 4 months, at 6 months, and at 8 months; but it is agreed to make one payment of the whole. Required the equated time. Ans. 5 months.

* When no particular sum is given, any sum may be assumed

5. A man bought a quantity of goods, to pay $\frac{1}{3}$ at the end of every 3 months, till the whole was paid; but it is agreed to make one payment of the whole. Required the equated time. Ans. 6 months.

6. A debt of 420 dols. is due at the end of 6 months, but the debtor will pay 60 dols. now, provided the rest may be forborne a longer time, which is agreed on. Required the time.

	dols.			
	420			
Paid present,	60			
	—	months.		
Remains,	360	: : 6 ::	420	
			6	
			—	
			360)2520(7 months, Ans.	
			252	
			—	

Note. In the 6th example, it is evident that if part is paid now, the remainder ought to be forborne a longer time. See the stating, agreeably to the general method of stating the Rule of Proportion.

DISCOUNT.

Discount is an allowance made for the payment of a sum of money before it becomes due, and is the difference between the sum due, at a time to come, being specified and the sum which ought to be paid at the present time, (called the present worth) which if put to interest would amount to the given sum at the time specified.

Discount is also sometimes allowed on depreciated money, such as foreign coin, the bills of some banks, &c; in this case it is commonly at so much per cent; in the former case so much per cent. per annum.

Case I. To find the discount on a sum of money payable on a future day, provided the same be paid at the present time; the sum and rate of discount being given.

RULE 1. As 12 months, or 365 days, are to the rate per cent, so is the time proposed, to a fourth number, or sum.

2. Add that fourth number, or sum, to 100 pounds, or 100 dollars, (as the given sum may be.)

3. As this last sum is to the fourth number, so is the given sum to the discount.

EXAMPLES.

1. Required the discount of £795 11 2, for 11 months, at 6 per cent. per annum?

12 : 6 :: 11
6

12)66

5½ or £5 10
Add 100

105 10 : 5 10 :: 795 11 2
20 20 20

2110 110 15911
12 12

25320 190934
110

2532|0)21002740(82|9
20256

£41 9 5 1572/2532, Ans.

7467
5064

24034
22788

1246
12

14952(5
12660

2292
4

9168(3
7596

1572

2. What is the discount of dols. 9356,25, for 2 years and 5 months, at 5 per cent. per annum?

Ans. dols. 1008,65,6+

3. What is the discount of dols. 957,26, for 7 months, at 6 per cent. per annum? Ans. dols. 32,37,1+

CASE II. To find the present worth of a given sum, payable at a future day, having the rate per cent given.

RULE. Proceed as directed in Case I, till the fourth number or sum is found and added to 100; then say, as that sum is to 100, so is the given sum to the present worth; or, find the discount as directed in the 1st Case, and subtract it from the given sum; the remainder will be the present worth.

EXAMPLES.

1. Required the present worth of £795 11 2, for 11 months, at 6 per cent. per annum.

12 : 6 :: 11

11

12)66

5 5 or £5 10

100

105 10 : 100 :: 795 11 2

20 20

2110 15911

12 12

25320 190934

100

2532|0)190934|0(£754 1 8$\frac{0}{1}$ $\frac{960}{2532}$ Ans.

17724

13694

12660

10340

10128

212

20

4240

2532

1708

12

20496

20256

240

4

960

This proves the first example in Case I.

Or, thus, From the given sum £795 11 2

Subtr. discount, Found by Case I Example 1, Remains the present worth,

41 9,5$\frac{1}{4}$ $\frac{1572}{2532}$

754 1 8$\frac{0}{4}$ $\frac{960}{2532}$

2. Required the present worth of dols. 9356,25, for 2 years, and 5 months, at 5 per cent. per annum.

Ans. dols. 8347,59,3+

3. What is the present worth of 4000 dols. payable in 9 months, at 4,75, or $4\frac{3}{4}$ per cent. per annum?

Ans. dols. 3862,40,1+

4. Suppose 810 dols. were to be paid 3 months hence; allowing 5 per cent discount, what must be paid in hand, or at the present time? Ans. 800 dols.

5. If a legacy be left me July 24, 1808, to be paid on the following Christmas day, what must I receive when I allow 6 per cent. per annum, for present payment, the legacy being 1000 dols. Ans. dols. 975,15,3+

6. Being obliged by note, dated August 29, 1807, to pay on the 24th of June, 1808, (which is leap year,) £326, what must I pay down if I am allowed a discount at the rate of 8 per cent. per annum?

Ans. £305,16,6$\frac{1}{2}$+

When goods are sold, and payment to be made at different times, to find the discount or present worth of the whole.

Rule. Find the discount or present worth of each payment for its time, and add them together, their sum will be the discount, or the present worth of the whole.

This is the truest and most accurate method, but the discount or the present worth of several payments may be found very near the true sum, by finding the equated time, and then use that time, as if it had been a time given to pay the whole.

By this last method the discount will be greater, and the present worth less than by the true method; the seventh example by this last method gives the present worth dols. 3062,57,6+ but the true present worth is dols. 3052,69,6+ Also, the eighth example, instead of the true present worth, dols. 296,06,1+ would be dols 296,05,2+ by this last method; the ninth example, instead of dols. 975,67,4+ would be dols. 975,60,9+; the tenth example would be dols. 198,01,9+ instead of dols. 198,02,2+

Note. When the sums are large, the true method ought always to be preferred. When no time is mentioned, a year's interest is the discount.

7. Sold goods for dols. 3120, to be paid in two 3 months, (that is, half at 3 months, and the other half at 3 months after that,) what must I receive present payment, if I allow a discount at the rate of 5 per cent. per annum? Ans. dols. 3062,69,6+

8. Sold goods for 300 dols. to be paid at three 2 months, (that is $\frac{1}{3}$ at 2 months, $\frac{1}{3}$ at 4 months, and $\frac{1}{3}$ at 6 months) what must I receive for present payment, if I allow a discount at the rate of 4 per cent. per annum? Ans. dols. 296,96,1+

9. What is the present worth of 1000 dols. payable at two 4 months, discount 5 per cent. per annum? Ans. dols. 975,67,4+

10. What is the present worth of 200 dols. at 4 per cent. per annum discount, payable 100 dols. at 2 months, 50 dols. at 3 months, and 50 dols. at 5 months? Ans. dols. 198,02,2+

Bank Discount.

Bankers find the interest of the sum, from the date of the note, to the time of payment, including the days of grace; this interest is called the discount; i. e. if a note, dated the 1st of August, 1809, be discounted at a bank for 30 days, the interest of the note for 33 days is the discount, if 3 days of grace are allowed; because the borrower can withhold the payment for 33 instead of 30 days.

When a new note is given (on account of its being inconvenient to pay at the specified time) it must be presented on the day of discount immediately preceding the expiration of time of payment specified in the note, paying the discount as before, for the time.

If a note of 100 dols. dated August 1, 1809, for 30 days, though it is not payable till the 2d of September, (yet if not paid) a new note must be replaced on Tuesday, the 29th of August, (if Tuesdays are the days of discount, and no other day in the week) paying discount as before, for the time it is to bear interest, including the days of grace.

The usual method of finding the discount in banks for 30 or 60 days is, by multiplying the sum by one sixth part of the days, (including the days of grace,) and pointing off 3 places of the right hand figures, those at the left of the point will be dollars, if dollars only are multiplied. If dollars and cents, or dollars cents and mills, or cents only, or mills only, are multiplied; after pointing off the three right hand figures from the product, the others will be of the same denomination, with the lowest multiplied.

Always take a sixth part, the given days increased by three, i. e. if 30 days, take for 33, if 60 for 63, &c.

EXAMPLES.

1. How much must be discounted for a note of 476 dols. at 30 days?

476
6)33 ($=5\frac{1}{2}$ multiplier.

2380
238

dols. 2,61,8 Ans.

2. How much is to be discounted for a note of 438 dols. at 60 days?

438
6)63($=10\frac{1}{2}$

4380
219

dols. 4,59,9 Ans.

NOTE 1. In these examples three days of grace have been calculated for.

Note 2. If the unit figure in the dollars given is 1, 3, 5, 7 *or* 9, *there will be one half mill in the discount.*

	Dollars.	For days.	Discount.
3	477	30	dols. 2,62,2
4	4388	30	24,13,4
5	7365	30	40,50,7½
6	367	30	2,01,8½
7	1372	60	14,40,6
8	9327	60	97,93,3½
9	865	60	8,93,2½
10	1572	90	19,65
11	423	90	5,28,7½
12	7645	90	95,56,2½
13	372,45	30	2,14,8,475
14	564,36	30	3,10,3,98
15	583,55,4	30	3,21,4,547
16	436,57	60	4,68,3,985
17	473,17,5	60	4,96,8,3375
18	597,36,9	90	7,46,7,1125

Note. In the six last examples the decimals of a mill are inserted for the satisfaction of the pupil.

EXCHANGE.

Exchange is the giving the bills, money, weight, or measure of one place or country, for the like value in the bills, money, weight, or measure of another place or country; in doing which it is necessary to know how to change any sum of money, or any weight, &c. of one place or country, to a sum or weight, &c. of another country, or place, of equal value.

This is done by finding what proportion a certain sum of the money of one country or place, bears to the like sum of the money of the other country or place, and using these proportional numbers as follows, viz.

1. If the given sum or weight be of more value than a like sum or weight in the place required,

Multiply it by the greater of these proportional numbers, and divide the product by the less.

2. If the given sum or weight be of less value than a like sum or weight in the place required.

Multiply the given sum or weight by the less of these proportional numbers, and divide the product by the greater, the quotient in either case will be the sum or weight required, of equal value with that given.

Questions in Exchange may be proved by varying their order.

Note. In many instances the money or weight of one place may be changed to that of another by adding to, or subtracting from the given sum or weight, a certain proportion, as in many of the following examples.

To change the currency of New England and Virginia to Federal money.

Case I. When pounds only are given, annex a cipher, and then divide by 3, the quotient will be dollars; if any remains, annex to it two ciphers, and then divide by 3 for cents; if there is still a remainder, and you wish to know the value to a lower denomination, annex one cipher and divide by 3 for mills.

Case II. If pounds and shillings are given.

When the number of shillings given is even, as 2, 4, &c. annex half their number to the pounds, and divide by 3, &c. as above.

If the number of shillings given be odd, as 1, 3, 5 &c. then after annexing half the greatest even number of shillings to the pounds, annex 50; and divide by 3 gives cents. If there be a remainder, annex a cipher, and divide by 3 for mills.

Case III. If pounds, shillings and pence, &c. are given.

Proceed as in the last cases with the shillings, and then add a number equal to the farthings, the pence and farthings will make, increased by one, if they make more than 12, and not more than 37; but if more than 37 increase it by 2, then divide by 3 gives cents; if any remains, annex a cipher to it, and divide by 3 gives mills.

EXAMPLES.

1. In £736 how many dollars?

3)7360 00 0

dols. 2453,33,3+ Ans.

2. Change £9365 11 to dollars.

3)9365 50 0

dols. 3121,83,3+ Ans.

3. In £1166 12, how many dollars?

3)1166 00 0

dols. 388,66,6+ Ans.

4. Change £437 15 3½ to dollars.

437750

14+1= 15 farthings.

3)437 7 6,50

dols. 1459,21,6+ Ans.

5. In £5734, how many dollars?

Ans. dols. 19113,33,3+

6. In £1136 12, how many dollars?

Ans. dols. 3788,66,6+

7. In £9726 13 9½, how many dollars?

Ans. dols. 32422,30.

To change federal money to New England and Virginia currency.

CASE I. If dollars only are given.

Multiply them by 3, and double the first figure in the product for shillings, the others will be pounds.

NOTE. If the shillings made by doubling the first figure exceed 20, *or* 40, *&c. set down the excess above twenties, and carry one for each twenty.*

CASE II. If dollars and cents, or cents only are given.

Multiply by 3, and point off the three right hand figures for decimals; if there are not three figures in the product, supply the deficiency by prefixing a cipher,

or ciphers; if there are any figures at the left of the point they are pounds.

Multiply the decimals by 20, and point off three again; if there are any figures at the left of this point, they are shillings.

Multiply these second decimals by 12, and point off three; if any figures are at the left of this point, they are pence.

Multiply these decimals by 4, and point off three; if there are any at the left of the point, they are farthings.

Note. If there are mills given, point off four in every instance.

Case III. If cents and mills only, or mills only are given.

Multiply by 3, and point off four figures; if there are not four, prefix ciphers to complete that number of places; then,

Multiply by 20, 12, and 4, as above, for shillings, pence and farthings, observing to point off four figures in this case, after each multiplication.

Examples.

1. In 567 dols. how many pounds, &c.?

567
3

£170 2 Ans.

2. Change dols. 97,80, to pounds, &c.

97,80
3

29|340
20

6|800
12

9|600
4

2 400

Ans. £29 6 9¼

3. In 9 mills, how much New England Currency?

9
3
0027
20
0540
12
6480
4
2 5920

Ans. 2,592 farthings.

4. In cents 36,5, how many pounds?

36,5
3
1095
20
2 1900
12
2 2800
4
1 1200

Ans. £0 2 2¼+

5. In $19113,33,3, how many pounds, &c.?
Ans. £5733 19 11¼+

6. Change $3788,66,6 to pounds, &c.
Ans. £1136 11 11¼+

7. In $32422,30, how many pounds, &c.?
Ans. £9726 13 9¼+

To change the currency of New York, and North Carolina to federal money.

Let the preparations, before dividing, be the same in all cases as in reducing New England currency to federal money, but divide by 4, instead of 3, through the whole process.

EXAMPLES.

1. In £936, how many dollars?

4)9360

$2340 Ans.

2. In £7364 12, how many dollars?

4)73646,00

$18411,50 Ans.

3. In £11 17 9¼, how many dollars?

11850
41

4)118,91,0

$29,72,7¼ Ans.

4. In 7½d. how much federal?

7½
4
30
+ 1

4)31,0 Ans. $0,07,7.

7,7

5. Change £5376, to dollars. Ans. $13440.
6. In £1176 12, how many dollars? Ans. $2941,50.
7. Change £9378 17 9¼ to dollars. Ans. $23447,22.

To change federal money to the currency of New York and North Carolina.

Proceed in all respects as in reducing federal to New England currency, except that you here multiply by 4, as in that you made 3 the multiplier.

EXAMPLES.

1. Change $2340 to pounds.

2340
4

£936 0 Ans.

2. In $18411,50, how many pounds, &c.?

18411,50
4

7364 | 600
20
12 | 000

Ans. £7364 12.

3. Change $29,72,7, to pounds, &c.

29,72,7
4

11 | 8908
20
17 | 8160
12
9 | 7920
4
3 | 1680

Ans. £11 17 9¾+

4. In cents 7, 7, how much New York currency?

7, 7
4

0308
20
6160
12
7 | 3920
4
1 | 5680

Ans. 7¼d.+

5. In $13440, how many pounds, &c? Ans. £5376.

6. In $2941,50, how many pounds, &c.?
Ans. 1176 12.

7. Change $23447,22, to pounds, &c.
Ans. £9378 17 9¼.

To change the currency of New Jersey, Pennsylvania, Delaware, and Maryland to federal money.

Case I. If the given sum be pounds only, multiply by 8, and divide by 3, for dollars; if any remains, consider it as a decimal, and divide for cents and mills; or, to the product by 8, annex two ciphers, if you would have the cents, three if you would have the mills, and divide by 3.

Case II. If pounds and shillings; or pounds, shillings, and pence; or shillings and pence; or pence only are given: reduce the whole to pence, divide these pence by 9, and add the quotient to the pence; the sum will be cents; if any remains after dividing the pence by 9, it will be so many mills, and decimals of a mill over.

Case III. If there are farthings in the given sum, after reducing it to pence, annex the farthings in decimal parts of a penny: thus $\frac{1}{4}$ will be ,25; $\frac{2}{4}$,5; $\frac{3}{4}$,75 of a penny.

Note. If for the farthings you annex ,5, the answer will be in mills; if you annex ,25, or ,75, it will be mills, and decimals of a mill.

Examples.

1. In £333, how many dollars?

333
8

3)2664

Ans. $888 Ans.

2. In £666 17, how many dollars?

666 17
20

13337
12

9)160044 0

17782 7

$1778,26,7 Ans.

3. Change £526 9 7¼ to dollars.

526 9 7¼
20

10529
12

9)126355,25
14039,47

$1403,94,7,2 Ans.

4. Change 7¼d. to cents.

2)7 5
3 8

cents, 3 8,3 Ans.

5. Change £600 to dollars. Ans. $1600.
6. In £930 7 6, how many dollars? Ans. $2481.
7. In £1136 7 9¼, how many dollars, &c?
Ans. $3030,37,5.

To change federal money to the currency of New Jersey, Pennsylvania, Delaware, and Maryland.

Case I. If dollars only are given, multiply by 3, and divide the product by 8 for pounds; if any remains, multiply it by 20, and divide the product by 8, for shillings; if there be any then remaining, multiply it by 12, and divide by 8 for pence; if there is still a remainder, multiply it by 4, and divide by 8 for farthings.

Case II. If the given sum be dollars and cents, divide them by 10, and subtract the quotient, the remainder is pence; if any remain after dividing by 10, it will be decimals of a penny; which, if multiplied by 4, and the same number of decimals pointed off, gives farthings, if any be at the left of the point.

Case III. If dollars, cents and mills, or cents and mills, or mills only are given.

Subtract a tenth (as in Case II.) of the whole in mills, from it; if the remainder is mills only, they are decimals of a penny to be multiplied by 4, &c. as in Case II. for farthings, but, if there are cents, they are so many pence.

1. Change £888 to pounds.

888
3

8)2664

£333 Ans.

2. Change £1778,26,7, to pounds.

10)1778267
177826 7

12)160044 03

2|0)1333|7 0 $\frac{1}{10}$

£666 17 $\frac{03}{100}$ Ans.

3. Change £1403,72,4 to pounds.

10)1403724
1403724

12)12633516

2|0)1052|7,9 36

£526 7 9 $\frac{36}{100}$ Ans.

4. In 8 cents, 3 mills, how much New Jersey, &c. currency?

8,3
8,3

7,4 7
4

1,88

Ans. 7$\frac{1}{4}$d. $\frac{8}{100}$.

5. Change 1600 dols. to pounds. Ans. £600.

6. Change £2481 to pounds, &c. Ans. £930 7 6.

7. Change dols. 3030,37,5, to pounds, &c.

Ans. £1136 7 9$\frac{1}{4}$.

To change the currency of South Carolina, and Georgia, to Federal money.

Case I. If the given sum be pounds only, multiply by 30, and divide the product by 7 for dollars; if any remain, annex to it two ciphers, if you would have

cents only, but three, if you would have mills also; and divide them by 7, for cents and mills.

CASE II. If the given sum be pounds and shillings, or pounds, shillings, and pence, or shillings and pence, or pence only.

Reduce the whole to pence, and divide by 56, for cents: if any remains, annex a cipher, and divide it by 56 for mills.

CASE III. If there are farthings in any given sum after reducing it to pence, instead of annexing two ciphers for ¼, annex ,25, for ½, ,50, for ¾, ,75; and then proceed as in Case II.

EXAMPLES.

1. In £936, how many dollars?

936
30

7)28080 00 0

Ans. dols. 4011,42,8+

2. In £487 16, how many dollars?

487 16
20

9756
12

56)11707200(209057,1+
112

507
504

320
280

400
392

80
56

24

3. In £56,9 7½, how many dollars?

56 9 7½
20
N29
12
56)13555,50(8242,04,4+ Ans.
112
235
224
115
112
350
224
260
224
36

4. In 7½d. how much federal money?

56)7,75(13cts. 8 mills, Ans.
56
215
168
470
448
22

5. In 1½d. how much federal money?

56)1,25(2cts. 2 m. Ans.
112
130
112
18

6. Change £46 13 to dollars, &c. Ans. $199,50
7. Change £97 16 6 to dollars, &c. Ans. $419,25
8. Change £10 11 0¼ to dollars, &c. Ans. $45,21,3+

To change federal money to the currency of South Carolina and Georgia.

Case I. If the given sum be dollars only, multiply by 7, and divide the product by 30, the quotient will be pounds; if any remains, multiply it by 20, and divide the product by 30, for shillings; if there is another remainder, multiply it by 12, and divide the product by 30, for pence; if there is still a remainder, multiply it by 4, and divide the product by 30, for farthings.

Case II. If the given sum be dollars and cents; multiply by 56, and point off the two right hand figures, the others will be pence, and those pointed off, decimals of a penny; which multiply by 4, and point off the two right hand figures, the other is farthings.

Case III. If dollars cents and mills are given; or cents and mills; or mills only; multiply by 56, and point off the three right hand figures from the product, the others will be pence; then proceed with those pointed off, as in Case II. only observe to point of three in this, as you did two in that case.

Examples.

1. In 200 dols. how many pounds?

200
7

3|0)140|0

46 20
20

3|0)40|0

13 10
12

3|0)12|0

4

Ans. £46 13 4.

2. In dols. 200,28, how many pounds, &c. ?

200,28
56

120168
100140

12)11215,68

2|0)934,7½

£46 14 7½ $\frac{78}{100}$ Ans.

3. In cents 13,8, how much currency of South Carolina, &c. ?

13,8
56

828
690

7|728 Ans. 7½d. $\frac{812}{1000}$.
4

2|912

4. In cents 2,2, how much currency of South Carolina, &c. ?

2,2
56

132
110 Ans. 1d. $\frac{232}{1000}$.

1|232
4

928

5. In dols. 199,50, how many pounds, &c ?
Ans. £46 11.

6. Change dols. 449,25, to currency of South Carolina, &c. Ans. £97 16 6.

7. In dols. 45,21,8, how many pounds, &c. ?
Ans. £10 11 0 $\frac{208}{1000}$.

To change the currency of New England and Virginia, to that of New York and North Carolina—Add one third.

EXAMPLES.

1. In £736 10 6 New England currency, how much New York, or North Carolina currency?

3)736 10 6
245 10 2

Ans. £982 0 8

2. In £117 13 9, New England currency, how much in the currency of New York or North Carolina?

Ans. £156 18 4.

To change the currency of New York and North Carolina, to that of New England—Subtract one fourth.

EXAMPLES.

1. In £982 0 8, currency of New York, or North Carolina, how much in the currency of New England?

4)982 0 8
245 10 2

Ans. £736 10 6

2. In £156 18 4, currency of New York, or North Carolina, how much in the currency of New England?

Ans. £117 13 9.

To change the currency of New England to that of New Jersey, Pennsylvania, Delaware, or Maryland—Add one fourth.

To change the currency of New Jersey, Pennsylvania, Delaware, or Maryland, to that of New England—Subtract a fifth.

To change the currency of New England, or Virginia, to that of South Carolina, and Georgia—Multiply by 7, and divide the product by 9.

To change the currency of South Carolina, and Georgia, to that of New England or Virginia—Multiply by 9, and divide the product by 7.

To change the currency of New York or North Carolina, to that of New Jersey, Pennsylvania, Delaware, or Maryland—Subtract one sixteenth.

To change the currency of New Jersey, Pennsylvania, Delaware, or Maryland, to that of New York, or North Carolina—Add one fifteenth.

To change the currency of New York, or North Carolina, to that of South Carolina, or Georgia—Multiply by 7, and divide the product by 12.

To change the currency of South Carolina, or Georgia, to that of New York, or North Carolina—Multiply by 12, and divide the product by 7.

To change the currency of New Jersey, Pennsylvania, Delaware or Maryland, to that of South Carolina, or Georgia—Multiply by 56, and divide the product by 90.

To change the currency of South Carolina or Georgia, to that of New Jersey, Pennsylvania, Delaware, or Maryland—Multiply by 90, and divide the product by 56.

To change sterling to federal money.

Case I. If pounds, or pounds and shillings are given, reduce the whole to six-pences, and divide them by 9, for dollars; if any remains, and you would have it in cents, annex two ciphers, and divide by 9; if there be still a remainder, and you would have mills, annex one cipher to it, and divide by 9.

Case II. If pounds, shillings, and pence are given, or shillings and pence, or pence only.

To the pence in the whole given sum, annex two ciphers, if you would have the answer to cents; or three, if you would have it to mills, and divide by 54, or by 6, and by 9; because 9 times 6, or 6 times 9, are equal to 54.

Case III. If there are farthings in the given sum, instead of annexing ciphers as in Case II, annex for ¼, ,25 for cts; or ,250, for mills; for ½ annex ,50 for cents, or ,500 for mills; and for ¾, annex ,75 for cents, or ,750 for mills; and in either case divide by 54, or by 6, and by 9.

EXAMPLES.

1. Change £4368 sterling to dollars.

4368
40 six-pences in a £

9)174720 00 0

$19413,33,3 Ans.

2. Change £936 15 sterling, to dollars.

936 15
40 2

37440 30
30

9)37470 00 0

$4163,33,3 Ans.

3. Change £73 9 4 sterling, to dollars.

£73 9 4
20

1469
12

54)17632 00($326,51,8+ Ans.
162

143
108

352
324

280
270

100
54

460
432

28

Or thus,

6)17632000

9)2938666

$326,51,8 Ans.

4. Change 5s. 7½d. to dollars.

5 7½
12

54)6750(125 Ans.
54
135
108
270
270

5. Change 7½d. sterling to federal money.

54)750(13cts. 8m. + Ans.
54
210
162
480
432
48

6. Change £836 16 sterling, to dollars, &c.
Ans. $3719,11,1.

7. Change £573 6 4¼ sterling to dollars, &c.
Ans. $2548,08,7$\frac{13}{14}$

8. Change 11s. 3½d. sterling, to dollars, &c.
Ans. $2,50,9$\frac{14}{15}$.

To change federal money to sterling.

Case I. If dollars only are given, multiply by 9, and divide by 40 for pounds; if any remains, divide it by 2, for shillings; if there is still a remainder, multiply it by 12, and divide by 2, for pence.

Case II. If cents are given with dollars, or cents only, multiply the whole by 54, or by 9, and by 6, and point off the two right hand figures, the others will be pence; those pointed off are decimals of a penny, which must be multiplied with 4, and two pointed off, the other is farthings.

Case III. If mills are given with dollars and cents, or mills only are given, multiply by 54, or by 9, and by 6; and point off three from the right, the others will be pence; those pointed off must be multiplied by 4, and three pointed off, the others will be farthings.

EXAMPLES.

1. In $1600, how many pounds sterling?

1600
9

4|0)1440|0

£360 Ans.

2. Change $803,50 to sterling.

803,50
54

321400
401750

12)43389,00

2|0)361|5 9

£180 15 9 Ans.

3. Reduce 25 cts. 4 m. to sterling.

25,4
9

2286
6

13|716
4

2|864

25,4
54

1016
1270

13|716
4

2|864

Ans. 1s. 1½d.+

4. Change $900 to sterling. Ans. £202 10.
5. Change $1196,46 to sterl. Ans. £268 14 0¼ 84/100.
6. In $1126,66,6, how many pounds, &c. sterling?
Ans. £269 4 0½+
7. In dols. 2573,84,7, how much sterling?
Ans. £579 2 3½ 252/1000.

To change Irish money to federal.

First reduce the Irish money to half-pence, and then divide the half-pence, by 117 for dollars; if any remain, annex two ciphers to it, and divide by 117 again for cents; if there is still a remainder, annex one cipher to it and divide by 117 for mills; Or,

Change the Irish to sterling, by subtracting one thirteenth part of it, and then proceed with it as for sterling.

EXAMPLES.

1. Change £936 12 6 Irish money to federal?

First method.	Second method.
936 12 6	13)936 12 6
20	72 0 11½
18732	864 11 6½
12	20
224790 (9 times 13 is equal to 117.)	17291
2	12
9)44958000	54)207498 50)$3842,56+ Ans.
13)4995333	162
$3842,56+ Ans.	454
	432
	229
	216
	138
	108
	305
	270
	350
	324
	26

Or thus,

6)20749850

9)3458308

$3842,56+

2. Change £1136 14 8 Irish, to federal.

Ans. $4663,52+

To change federal to Irish money.

Multiply dollars by 117, gives half-pence.

Multiply cents by 117, and point off the two right hand figures.

Multiply mills by 117, and point off the three right hand figures; those figures at the left of the points will be half-pence Irish money.

EXAMPLES.

1. Change $573 to Irish money. Ans. £199 13 4½
2. Change $736,42 to Irish money. Ans. £179 10 0½+
3. Change $964,57,3, to Irish money.

Ans. £235 2 3½+

To change sterling to the currency of New England and Virginia—Add one third.

EXAMPLES.

1. An invoice of goods from Liverpool in England, amounts to £936 9 8 sterling; how much is it in the currency of New England or Virginia?

3)936 9 8

312 3 $2\frac{2}{3}$

Ans. £1248 12 $10\frac{2}{3}$

2. In £1236 9 8 sterling, how much in the currency of New England or Virginia? Ans. £1648 12 $10\frac{2}{3}$.

To change the currency of New England, or Virginia, to sterling—Subtract one fourth.

EXAMPLES.

1. Remitted from Boston to London, £1248 12 $10\frac{2}{3}$; how much is it in sterling money?

4)1248 12 $10\frac{2}{3}$

312 3 $2\frac{2}{3}$

Ans. £936 9 8

2. Remitted from Boston to Liverpool in England, £1648 12 $10\frac{2}{3}$, how much is it in sterling money?

Ans. £1236 9 8.

To change sterling to the currency of New York, or North Carolina—Multiply by 16, and divide the product by 9.

EXAMPLES.

1. In £596 14 8 sterling, how much New York, or North Carolina currency?

596 14 8

4

2386 18 8

4

9)9547 14 8

Ans. £1060 17 $2\frac{2}{9}$

2. In £1196 5 6 sterling, how much New York, or North Carolina currency? Ans. £2126 14 $2\frac{2}{9}$

To change the currency of New York or North Carolina to sterling—Multiply by 9, and divide the product by 16.

EXAMPLES.

1. Remitted from New York to London, £1060 17 2¼, how much is it in sterling money?

1060 17 2¼
9

6)9547 14 8

4)2386 18 8

Ans. £596 14 8

2. In £2126 14 2¼ New York, or North Carolina currency, how much sterling? Ans. £1196 5 6.

To change sterling to the currency of New Jersey, Pennsylvania, Delaware, or Maryland—Multiply by 10, and divide the product by 6.

EXAMPLES.

1. In £9000 sterling, how much in the currency of New Jersey, &c.?

9000
10

6)90000

£15000 Ans.

2. In £54 4 6 sterling, how much in the currency of New Jersey, &c.? Ans. £90 7 6.

To change the currency of New Jersey, Pennsylvania, Delaware, or Maryland, to sterling—Multiply by 6, and divide the product by 10.

EXAMPLES.

1. In £90 7 6, currency of New Jersey, &c. how much sterling? Ans. £54 4 6.

2. In £15000 currency of New Jersey, &c. how much sterling? Ans. £9000.

To change sterling to the currency of South Carolina, or Georgia—Multiply by 28, and divide the product by 27.

EXAMPLES.

1. In £1115 10 6 sterling, how much currency of South Carolina, &c.? Ans. £1156 16 $9\frac{1}{4}\frac{3}{27}$.

2. In £6358 11 $7\frac{1}{4}$ sterling, how much currency of South Carolina, or Georgia? Ans. £6549 1 $8\frac{6}{27}$.

To change the currency of South Carolina, or Georgia, to sterling—Multiply by 27, and divide the product by 28.

EXAMPLES.

1. In £1156 16 $9\frac{1}{4}\frac{3}{27}$ currency of South Carolina, or Georgia, how much sterling? Ans. £1115 10 6.

2. In £6594 1 $8\frac{6}{27}$ currency of South Carolina, or Georgia, how much sterling? Ans. £6358 11 $7\frac{1}{4}$.

To change federal money to the currency of Canada, Nova Scotia, Brunswick, &c.

Multiply dollars by 5, gives shillings,
Multiply cents by 60, gives pence,
Multiply mills by 240 gives farthings,
} which may be reduc. to their proper terms.

To change the currencies of Canada, Nova-Scotia, and New Brunswick, to federal money.

Divide shillings by 5 for dollars; pence by 60, and farthings by 240.

ALLIGATION MEDIAL

Teaches how to find the mean price of several articles mixed, by having the quantity and value of the several articles mixed, given.

RULE. Find the quantity and value of the whole mixture, then say, as the whole composition, or mixture, is to its total value, so is any part of the composition, to its mean price or value.

EXAMPLES.

1. A grocer mixed 2cwt. of sugar at $9 per cwt. and 1 cwt at $7 per cwt. and 2cwt. at $10 per cwt; what is the value of 1 cwt. of this mixture?

2 cwt. at $9 = $18
1 cwt. at $7 = 7
2 cwt. at $10 = 20

5 : 45 :: 1
1

5)45

Ans. $9

2. A refiner mixed 3lb. of gold, of 22 carats fine, with 3lb. of 20 carats fine, I demand the fineness of this mixture. Ans. 21 carats.

3. A farmer mixed 19 bushels of wheat, at 1 dol. per bushel, and 40 bushels of rye, at 66 cts. per bushel, and 11 bushels of barley, at 50 cents per bushel; what is a bushel of this mixture worth? Ans. $0,72,7½.

4. A vintner mixed 5 gallons of Canary, at dol. 1,30, with 6 gallons of Malaga, at dol. 1,20, and 4 gallons of white wine, at 1 dol. per gallon; what is a gallon of this mixture worth? Ans. dol. 1,18.

To prove questions in this rule, find the value of the whole mixture at the mean price, and if it agrees with the total value of the several quantities at their respective rates, the work is right.

ALLIGATION ALTERNATE

Teaches how, from the prices of several articles given, to find how much of each must be mixed, to bear a certain price proposed.

Rule. Place the prices one over the other, and the proposed price against them, as in the margin.

mean pri. 7 { 4 } prices. { 6 } of the { 8 } several { 10 } articl.

Link the several prices together, so that one greater than the mean price may be coupled to another which is less; thus,

7 { 4 / 6 / 8 / 10 }

Take the difference between each price, and the mean price, and set them down alternately, and they will be the quantities required.

EXAMPLES.

1. How much wheat at 1 dol. rye at 66 cents, and barley at 50 cents per bushel, must be mixed to make the mixture worth 75 cents per bushel?

mean price 75. { wheat 1,00 — 9 + 25 = 34; rye 66 — 25 = 25; barley 50 — 25 = 25 }

Ans. { 34 bushels of wheat. 25 do. rye. 25 do. barley. }

This is proved by Alligation Medial, thus,

34 bushels at 1 dol. is $34,00
25 rye at 66 cents, 16,50
25 barley at 50 cents, 12,50

84 | 84)6300(75 cents, proof.
588
420
420

2. How much canary wine, at dol. 1,50 per gallon, Malaga at dol. 1,20, and white wine at 1 dol. must be mixed together, that the mixture may be worth dol. 1,30 per gallon?

Ans. { 2 gallons of Canary. 1 do. Malaga. 1 do. White wine. }

3. How much sugar at 9 dols. per cwt. at 7 dols. per cwt. and at 10 dols. per cwt. must be mixed together, that the mixture may be worth 9 dols. per cwt?

Ans. { 2 cwt. at $9 1 do. at 7 2 do. at 10 }

NOTE. Other cases in Alligation might be treated of, but as they are of no real advantage, they are omitted.

DUODECIMALS.

Duodecimals are fractions of a foot, or of an inch, or of any part of an inch, having 12 for their denominators, useful in measuring mechanics' work, bales, boxes, &c.

Notation of Duodecimals.

F. I. u m m

Duodecimals are written thus: 5 7 2 5 8 &c. and are read thus: 5 feet, 7 inches, 2 seconds, 5 thirds, 8 fourths, &c.

Note. Some call the inches primes, and then the above

F. ' " "' "''

would stand thus: 5 7 2 5 8 &c.

Addition of Duodecimals.

Note. 12 fourths, 12 thirds, 12 seconds, 12 inches, } make { 1 third. 1 second. 1 inch. 1 foot.

Examples.

F.	'	"	"'	"''	F.	'	"	"'	"''	F.	'	"	"'	"''
25	7	2	5	7	43	6	3	5	6	73	4	6	1	7
46	2	7	3	5	36	4	7	4	3	47	7	2	8	2
65	5	3	6	2	24	2	2	6	9	36	3	7	5	9
56	4	6	4	6	63	1	9	2	6	24	5	4	9	6
74	4	9	6	4	56	5	8	6	5	25	7	5	10	4
56	9	4	8	6	63	7	4	7	8	52	4	9	3	9
31	6	8	5	9	75	9	9	5	2	63	8	4	6	2
356	4	6	4	3										

Subtraction of Duodecimals.

Examples.

	F.	'	"	"'	"''	F.	'	"	"'	"''	F.	'	"	"'	"''
From	97	7	3	5	7	57	3	6	9	4	637	1	7	3	6
Subtract	39	9	6	1	3	31	7	1	7	9	373	9	1	6	1
Remains	57	9	9	4	4										
Proof,	97	7	3	5	7										

Multiplication of Duodecimals.

By some called Cross Multiplication.

Note 1. *Feet multiplied by feet produce feet. Feet multiplied by inches, or inches by feet, produce inches. Feet multiplied by seconds, or seconds by feet, produce seconds. Inches multiplied by inches, produce seconds. Inches multiplied by seconds, or seconds by inches, produce thirds. Seconds multiplied by seconds, produce fourths, &c.*

Note 2. *The multiplicand must be multiplied by each denomination in the multiplier, and the several products added together, to obtain the true product.*

Note 3. *Sometimes it is easier to take parts, as in practice, with the less denominations instead of multiplying.*

Examples.

	F.	′	″	
1. Multiply	76	7	3	
By	3	6	4	
	229	9	9	‴
	38	3	7	6
	2	1	6	5

Ans. = 270 2 10 11

In this example I begin by multiplying by 3, saying 3 times 3 are 9 seconds, which I set down under the seconds; then say, 3 times 7 are 21 minutes, which is 9 more than 12; I set down the 9 under the minutes, and carry one for the 12, to the next denomination, saying 3 times 6 are 18, and 1 that I carry will make it 19 feet; this being the highest denomination, I set down all over 10, viz. 9, and carry one for the ten to the next, saying, 3 times 7 are 21, and 1 I carry makes 22; this being the left hand, or last figure to multiply, I set the whole down, viz. 22. I now come to the figure 6 in the multiplier, standing in the place of inches, and say 6 times 3 are 18, this is 6 over 12, and as inches and seconds multiplied together, produce thirds, I set down 6 in the place of thirds, and carry one to the next, &c.

The several products added together will be the true product.

Note. Sometimes it will be easier to take parts with inches, &c. instead of multiplying by them.

	F.	′
2. Multiply	7	4
By	3	6
	22	0
	3	8
Ans.	25	8

	F.	′	″	‴
3. Multiply	41	11	7	
By	9	3		
	377	8	3	‴
	10	5	10	9
Ans.	388	2	1	9

	F.	′	″
4. Multiply	96	3	8
By	15	7	3

96×5			=480			
96×1			=96			
6′	$\frac{1}{2}$	Half upper line,	=48	1	10	‴
1	$\frac{1}{6}$	of last line	= 8	0	3	8
3	$\frac{1}{3}$	of last	= 2	0	0	11
3	$\frac{1}{4}$	of 15 feet is	= 3	9	0	
6″	$\frac{1}{6}$	of 3′	= 0	7	6	
2	$\frac{1}{3}$	of 6″	= 0	2	6	
		Ans.	1502	9	2	7

5. A floor is 18 feet, 7 inches long, and 16 feet, 9 inches wide, what is the area of the floor?

Ans. 311 F. 3′ 3″.

6. What is the area of a floor, which is 26 feet, 3 inches long, and 9 feet, 9 inches wide?

Ans. 255 F. 11′ 3″.

7. A roof of a building measures 52 feet, 7 inches, by 56 feet, 3 inches, how many squares of 100 superficial feet each does this roof contain?*

Ans. 29 squares, 57 F. 9′ 9″.

* Flooring and roofing are done by the square of 100 superficial feet. Some partitions and ceilings are done by the square yard of 9 superficial feet each: also, plastering, paving, and painting, are done by the square yard.

8. A mason has paved a part of a street, which measures in length 236 feet, 8 inches, and in breadth 37 feet 8 inches; how many square yards does it contain?

Ans. 990 yds. 4 F. 5′.

9. A carpenter has ceiled the sides of a store, the walls of which are 9 feet, 10 inches high, and 150 feet, 6 inches about, and to be paid by the square yards; how many yards must he be paid for? Ans. 164 yds. 3 F. 11″.

10. A mason has plastered 3 rooms, the ceiling of each is 20 feet by 16½ feet, and the walls of each, 9½ feet high, and 73 feet about; there is to be 90 yards deducted for doors, windows, chimneys, &c. from the whole; how many yards must he be paid for?

Ans. 251 yds. 1 F. 6′.

11. A painter has painted the side of a building 40 feet long, 27½ feet high, (no deduction) how much will the painting come to, at 40 cents per yard?

Ans. $48,88,8⅓.

Duodecimals applied to Cubic Measure.

Stone walls of cellars, &c. are laid by the perch of 24¾ cubic feet each, the number of perches are found by first finding the number of solid (or cubic) feet; then multiply the cubic feet by 4, to reduce them to quarters, and divide the product by 99 (the number of quarters in 24¾) the quotient will be perches; the remainder so many ninety-ninths of a perch.

The cubic feet in a wall, or any other thing, are found by multiplying the length, breadth, and height together.

Examples.

1. In a cellar wall which is 9 feet high, 2½ feet thick, and the sides and ends together, were 131 feet, 5 inches, in length; how many perches did it contain?

```
  131  5
    9
  ----
 1182  9
    2  6
  ----
 2365  6
  591  4 6
  ----
 2956 10 6
    4 perches.
  ----
99)11827(119 97/99+
   99
   ---
   192
    99
   ---
    937
    891
    ---
     46
```

Note. In this example, when multiplying the cubic feet by 4, I call the 10 inches $\frac{1}{4}$, which I add to the product, saying 4 times 6 are 24, and 3 for the 10 inches, are 27, &c.

By this means I lose only $1\frac{1}{2}$ inch, which is $\frac{1}{8}$ of a foot; if more accuracy had been required, this $\frac{1}{8}$ might be added to the remainder, and then it would have given the answer thus, 119 perches $\frac{97}{198}$.

Timber and some kinds of stone are bought and sold by the solid (or cubic) foot, the contents being found by multiplying the length, breadth, and thickness together; timber is sometimes bought and sold by the ton.

2. A stone is 5 feet 3 inches long, 3 feet 7 inches wide, and 2 feet 9 inches thick; required the number of cubic feet it contains. Ans. 51 F. 8′ 9″ 9‴.

3. How many cubic feet in a piece of timber 37 feet long, $1\frac{1}{2}$ foot wide, and 1 foot 3 inches thick?

Ans. 69 F. 4′ 6″.

4. What will 9 pieces of timber come to, at $2,50 per ton, each piece being $29\frac{1}{2}$ feet long, 1 foot 9 inches, by 1 foot 7 inches, the side widths. Ans. $36,78+.

Diggers and fillers up of docks, wharves, &c. work by the square of 6 feet long, wide and deep, making 216 cubic feet to a square.

5. How many squares have been dug out of a cellar, 41 feet long, 21½ feet wide, and 8 feet 9 inches deep?

Ans. 35 squares, 153 F. 1′ 6″.

6. A dock has been filled, which was 126 feet 7 inches long, 50 feet 4 inches wide, and 12½ feet deep; how much does it come to at $2,75 per square?

Ans. $1013,96$\frac{14}{216}$.

The freight of bales, boxes, chests, trunks, &c. is commonly paid so much per cubic foot, or so much per ton.

7. How many cubic feet are in a box 7½ feet long, 4 feet 2 inches wide, and 3 feet 4 inches deep?

Ans. 104F. 2′.

8. How many tons (40 cubic feet to the ton) are in 7 bales, each 5 feet, 9 inches long, 4 feet wide, and 3 feet 5 inches thick? Ans. 13 tons, 30 F. 1′.

9 How much must be paid for the freight of 11 trunks, each being 4 feet long, 1 foot 7 inches wide, and 1 foot 4 inches deep, at $15,25, per ton?

Ans. $35,41,3 ,15

Grindstones are sold by the cubic foot, called a stone.

To find the number of stones (or cubic feet) contained in a grindstone, having the diameter and thickness given in inches.

Rule. Multiply the diameter by itself, then multiply this product by 11, divide the second product by 14, the quotient will be the superficial area of its side; then multiply this area by the thickness of the stone, in inches, and divide the product by 1728, the quotient will be the number of stones.

Examples.

1. How many stones are contained in a grindstone, its diameter being 36 inches, and 4 inches thick, and what is it worth at $1,25 per stone?

```
      36
      36
     ---
     216
     108
     ---
    1296
      11
    ----
14)14256  (  1018,2857
   14              4
   --      ---------
    25  1728(4073,1428(2,3571
    14      3456      1,25
    --      ----      ----
   116      6171     117855
   112      5184     282842
   ---      ----     ------
    40      9874  £2,94,6,275 Ans.
    28      8640
    --      ----
   120     12342
   112     12096
   ---     -----
    80      2468
    70      1728
    --      ----
   100       740
    98
    --
     2
```

2. What is the value of a grindstone 25 inches diameter, and 6 inches thick, at £1,75 ? Ans. £2,98,3+

3. Required the value of a grindstone 7 inches thick, and 41 diameter, at £2,10 per stone. Ans. £11,23,5,+

To find the tonage of double decked vessels.

RULE Multiply the length of the keel by the breadth on the main beam, and that product by the depth, (all in feet) and divide the last product by 95 for tons.

NOTE. Half the breadth on the main beam is called the depth of double decked vessels.

United States tonage is thus found :

Rule. Take the length from the fore part of the stem, to the hind part of the stern post, above the upper decks, the breadth at the broadest part above the main wales ; half this breadth is called the depth ; then deduct from the length $\frac{3}{5}$ of the breadth, the remainder multiply by the breadth, and that product by the depth, and divide this last product by 95, for tons.

For single decked vessels.

Rule. Take the length and breath as above, and subtract $\frac{3}{5}$ of the breadth from the length the remainder multiply by the breadth, and that product by the depth from the under side of the deck plank, to the ceiling at bottom ; divide this last product by 94 for tons.

Examples.

1. What is the tonage of a ship, 87 feet from the fore part of the stem, to the hind part of the stern post above her upper deck, and 25 feet wide, United States tonage ? Ans. 236 $\frac{80}{95}$.

2. What is the tonage of a schooner (single deck) 69 feet from the fore part of the stem, to the hind part of the stern post, 17 feet wide, and $7\frac{1}{2}$ feet deep ?

Ans. 79 $\frac{71}{94}$.

VULGAR FRACTIONS.

Vulgar Fractions are parts of an unit, (or whole number) and are expressed by two numbers with a line drawn between them, the number over the line is called the numerator, and that under it the denominator.

The denominator is the number of parts the unit is supposed to be divided into, and the numerator is the number of those parts the fraction contains ; $\frac{1}{2}$ is one half, i. e. an unit divided into halves, or two parts, this is one half, or one of those parts ; $\frac{3}{4}$ is three fourths, $\frac{25}{26}$ is twenty five twenty sixths, i. e. if an unit be divided into twenty six parts, it is twenty five of those parts.

Note. A remainder after division is a numerator of a fraction, of which the divisor is its denominator.

Vulgar Fractions are of four kinds, viz. proper, improper, compound, and mixed.

A fraction is said to be proper when the numerator is less than the denominator; thus, $\frac{1}{2}$, $\frac{3}{5}$, $\frac{4}{7}$, $\frac{16}{19}$, &c.

Improper fractions have their numerators greater than their denominators; thus, $\frac{4}{3}$, $\frac{7}{5}$, $\frac{19}{17}$, $\frac{21}{19}$, &c.

A compound fraction is a fraction of a fraction, thus, $\frac{1}{2}$ of $\frac{1}{4}$, $\frac{2}{3}$ of $\frac{1}{2}$, $\frac{3}{8}$ of $\frac{9}{12}$, &c. i. e. one half of three fourths, two thirds of one half, three eighths of nine twelfths, &c.

A mixed fraction consists of an integer, or whole number, with a fraction annexed; thus $7\frac{3}{8}$, $12\frac{7}{8}$, are expressed seven and three ninths, twelve and seven eighths, &c.

Note. Any whole number may be reduced to an improper fraction, by considering it as a numerator, and placing 1 *under it for a denominator, with a line drawn between them, thus,* $\frac{8}{1}$, $\frac{15}{1}$ $\frac{127}{1}$ *i. e. eight ones, fifteen ones, one hundred and twenty seven ones; here the* 8, *the* 15, *and the* 127, *are reduced to improper fractions.*

Reduction of Vulgar Fractions.

Case I. To reduce vulgar fractions to their lowest terms.*

Rule. Divide the numerator and denominator by such a number as will divide them both without a remainder; then divide these quotients (if need be) by the same, or any other number which will divide both without a remainder, &c. till no number except 1 will divide so: Or, find a common measure for dividing them at once; thus,

Divide the denominator by the numerator, then divide the numerator by the remainder, and then divide

* Fractions are said to be in their lowest terms when they are expressed by the least numbers possible, thus, $\frac{36}{1296}$, $\frac{48}{576}$, &c. when reduced to their lowest terms, will be $\frac{1}{36}$, $\frac{1}{12}$, &c.

the first remainder by the second, and the second remainder by the third, &c. till nothing remains; the last divisor will be the common measure by which the numerator and denominator must be divided, their quotients will be the lowest terms possible to reduce the fractions to.

EXAMPLES.

1. Reduce $\frac{36}{1296}$, to its lowest terms.

First method.

$12)\frac{36}{1296}(^{3})\frac{3}{108}(\frac{1}{36}$ Ans.

Second method.

36)1296(36
108

216
216

As nothing remains, 36 the divisor is the common measure.

36)1296(36 new denominator.
108

216
216

36)36(1 new numerator,
36 therefore the fraction in its lowest terms is $\frac{1}{36}$.

2. Reduce $\frac{48}{56}$ to its lowest terms. $8)\frac{48}{56}(\frac{6}{7}$ Ans.

3. Reduce $\frac{72}{94}$ to its lowest terms. Ans. $\frac{36}{47}$.

4. Reduce $\frac{84}{170}$, to its lowest terms. Ans. $\frac{42}{85}$.

5. Reduce $\frac{60}{125}$, to its lowest terms. Ans. $\frac{12}{25}$.

6. Reduce $\frac{182}{196}$ to its lowest terms. Ans. $\frac{13}{14}$.

7. Reduce $\frac{468}{1184}$, to its lowest terms. Ans. $\frac{117}{296}$.

8. Reduce $\frac{596}{1275}$ to it lowest terms. Ans. $\frac{596}{1275}$*.

CASE II. To reduce vulgar fractions of different denominations, to a common denominator.

RULE. Multiply each numerator into all the denominators, but its own, for a new numerator.

2. Multiply all the denominators together, for a common denominator.

* As no number, except 1, will divide these, without a remainder, it is already in the lowest terms possible.

EXAMPLES.

1. Reduce $\frac{3}{8}$ and $\frac{5}{6}$, to a common denominator.

$$\begin{array}{ccc} 3 & 5 & 8 \\ \frac{3}{8} & \frac{5}{6} & \frac{8}{6} \\ \hline 24 & 30 & 48 \end{array}$$

Ans. $\frac{24}{48}$ and $\frac{40}{48}$.

2. Reduce $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{11}{12}$, to a common denominator.

$$\begin{array}{cccc} 7 & 9 & 11 & 12 \\ \frac{7}{10} & \frac{9}{8} & \frac{11}{8} & \frac{12}{10} \\ \hline 70 & 72 & 88 & 120 \\ 12 & 12 & 10 & 8 \\ \hline 840 & 864 & 880 & 960 \end{array}$$

Ans. $\frac{840}{960}$ $\frac{864}{960}$ and $\frac{880}{960}$.

3. Reduce $\frac{4}{9}$, $\frac{7}{12}$, $\frac{6}{7}$, and $\frac{1}{2}$, to a common denominator.
Ans. $\frac{672}{1512}$, $\frac{882}{1512}$, $\frac{1296}{1512}$, and $\frac{756}{1512}$.

4. Reduce $\frac{6}{10}$, $\frac{4}{8}$, $\frac{1}{9}$, and $\frac{6}{7}$, to a common denominator.
Ans. $\frac{3024}{5040}$, $\frac{2520}{5040}$, $\frac{560}{5040}$, and $\frac{4320}{5040}$.

5. Reduce $\frac{4}{5}$, $\frac{1}{2}$, $\frac{5}{6}$, and $\frac{2}{8}$, to a common denominator.
Ans. $\frac{384}{480}$, $\frac{240}{480}$, $\frac{400}{480}$, $\frac{120}{480}$.

If these numerators were added together, and their sum exceed the denominator, then if the denominator be placed under the sum with a line drawn between them, it would be an improper fraction. See the result.

$$\begin{array}{r} 384 \\ 240 \\ 400 \\ 120 \\ \hline 1144 \end{array} \quad \frac{1144}{480} \text{ Improper fraction.}$$

CASE III. To reduce a mixed number to an improper fraction.

RULE. Multiply the whole number by the denominator of the fraction, and take in, or add to the product the numerator, their sum will be a new numerator, under which place the denominator of the fraction, with a line drawn between them, and they will be the improper fraction required.

EXAMPLES.

1. Reduce $12\frac{15}{17}$ to an improper fraction.

$$\begin{array}{r} 12\frac{15}{17} \\ \hline 99 \\ 12 \\ \hline 219 \end{array}$$

Ans. $\frac{219}{17}$.

2. Reduce $16\frac{18}{100}$, to an improper fraction.

$16\frac{18}{100}$

1618 Ans. $\frac{1618}{100}$.

3. Reduce $19\frac{12}{18}$ to an improper fraction. Ans. $\frac{354}{18}$.

4. Reduce $16\frac{25}{112}$, to an improper fraction.

Ans. $\frac{1817}{112}$.

5. Reduce $19\frac{2}{3}$, to an improper fraction. Ans. $\frac{59}{3}$.

CASE IV. To reduce an improper fraction to its proper terms.

RULE. Divide the numerator by the denominator.

NOTE. This case and Case III. prove each other.

EXAMPLES.

1. Reduce $\frac{219}{17}$, to its proper terms.

17)219(12$\frac{15}{17}$ Ans.
17

49
34

15

2. Reduce $\frac{1618}{100}$, to its proper terms. Ans. $16\frac{18}{100}$.

3. Reduce $\frac{354}{18}$, to its proper terms. Ans. $19\frac{12}{18}$.

4. Reduce $\frac{1817}{112}$, to its proper terms. Ans. $16\frac{25}{112}$.

5. Reduce $\frac{59}{3}$, to its proper terms. Ans. $19\frac{2}{3}$.

CASE V. To reduce compound to simple fractions.

RULE 1. Multiply all the numerators together for a new numerator.

2. Multiply all the denominations together for a new denominator.

EXAMPLES.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction.

$\frac{1}{2}$ $\frac{2}{3}$
$\frac{3}{6}$ new numerator. $\frac{6}{24}$ new denominator. Ans. $\frac{6}{24}=\frac{1}{4}$.

2. Reduce $\frac{7}{8}$ of $\frac{4}{6}$ of $\frac{9}{10}$ to a single fraction.

Ans. $\frac{252}{480}=\frac{21}{40}$.

3. Reduce $\frac{12}{14}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a single fraction.

Ans. $\frac{60}{168}=\frac{15}{42}$.

4. Reduce $\frac{5}{9}$ of $\frac{4}{5}$ of $\frac{3}{4}$ to a single fraction.
Ans. $\frac{60}{288}=\frac{5}{24}$.

CASE VI. To reduce the fraction of one denomination, to the fraction of another, but greater, retaining the same value.

RULE 1. Reduce the given fraction to a compound one, by comparing it with all the denominations between it, and that to which it is to be reduced.

2. Reduce this compound fraction to a single one, by Case V.

EXAMPLES.

1. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.
$\frac{5}{6}$ of a penny is $\frac{5}{6}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a pound.

5	6
5	12
3	72
1	20
3 numerator.	1440 denominator.

Ans. $\frac{5}{1440}=\frac{1}{288}$.

2. Reduce $\frac{1}{2}$ of a farthing to the fraction of a shilling.
Ans. $\frac{1}{96}$.

3. Reduce $\frac{8}{9}$ of an ounce Troy, to the fraction of a pound. Ans. $\frac{8}{108}=\frac{2}{27}$.

4. Reduce $\frac{6}{7}$ of a pound Avoirdupois, to the fraction of an hundred weight. Ans. $\frac{6}{784}=\frac{3}{392}$.

CASE VII. To reduce the fraction of one denomination to that of another, but less, retaining the same value.

RULE. Multiply the given numerator by all the denominations between it, and that to which it is to be reduced, for a new numerator, which place over the given denominator.

NOTE. This case and Case VI. prove each other.

EXAMPLES.

1. Reduce $\frac{1}{288}$ of a pound to the fraction of a penny.

1
20
20
12
240

Ans. $\frac{240}{288}=\frac{5}{6}$.

2. Reduce $\frac{2}{27}$ of a pound Troy, to the fraction of an ounce. Ans. $\frac{24}{27}=\frac{8}{9}$.

3. Reduce $\frac{1}{96}$ of a shilling to the fraction of a farthing. Ans. $\frac{48}{96}=\frac{1}{2}$.

4. Reduce $\frac{3}{3\,0\,8}$ of an hundred weight Avoirdupois, to the fraction of a pound. Ans. $\frac{3 \times 3 \times 8}{3\,0\,8} = \frac{6}{7}$.

CASE VIII. To reduce a fraction of one denomination to another of the same value, having the denominator of the required fraction given.

RULE. As the denominator of the given fraction, is to its given numerator, so is the denominator of the required fraction, to its required numerator.

EXAMPLES.

1. Reduce $\frac{3}{4}$ to a fraction of the same value, whose denominator shall be 20.

4 : 3 :: 20

20

—

4)60

—

15

Ans. $\frac{15}{20} = \frac{3}{4}$.

2. Reduce $\frac{1}{2}$ to a fraction of the same value, whose denominator shall be 46. Ans. $\frac{23}{46} = \frac{1}{2}$.

3. Reduce $\frac{6}{7}$ to a fraction of the same value, whose denominator shall be 49. Ans. $\frac{42}{49} = \frac{6}{7}$.

4. Reduce $\frac{75}{100}$ to a fraction of the same value, whose denominator shall be 4. Ans. $\frac{3}{4}$.

CASE IX. To reduce a fraction of one denomination, to another of the same value, having the numerator of the required fraction given.

RULE. As the numerator of the given fraction is to its denominator, so is the numerator of the required fraction, to its denominator.

NOTE. This case and Case VIII. prove each other.

EXAMPLES.

1. Reduce $\frac{15}{20}$ to a fraction of the same value, whose numerator shall be 3.

15 : 20 :: 3

3

—

15)60(4

60

Ans. $\frac{3}{4}$.

—

2. Reduce $\frac{23}{46}$ to a fraction of the same value, whose numerator shall be 1. Ans. $\frac{1}{2}$.

3. Reduce $\frac{42}{49}$ to a fraction of the same value, whose numerator shall be 6. Ans. $\frac{6}{7}$.

4. Reduce $\frac{3}{4}$ to a fraction of the same value, whose numerator shall be 75. Ans. $\frac{75}{100}$.

CASE X. To reduce a mixed fraction to a single one.

RULE 1. When the numerator is the integral part.

(1) Multiply the numerator of the fraction by the denominator of its fractional part, and to the product add (or take in) the numerator of its fractional part, for a numerator.

(2) Multiply the denominator of the fraction, by the denominator of its fractional part, for a denominator.

RULE 2. When the denominator is the integral part, then,

(1) Multiply it by the denominator of its fractional part, and to the product add (or take in) the numerator of its fractional part for a denominator.

(2) Multiply the numerator of the fraction by the denominator of its fractional part for a numerator.

EXAMPLES.

1. Reduce $\frac{42\frac{7}{8}}{49}$ to a single fraction.

$\frac{42}{8}$ $\frac{8}{343}$ $\frac{8}{392}$ Ans. $\frac{343}{392}$

2. Reduce $\frac{34\frac{1}{2}}{46}$ to a single fraction. Ans. $\frac{69}{92} = \frac{3}{4}$.

3. Reduce $\frac{17\frac{4}{9}}{43}$ to a single fraction. Ans. $\frac{157}{387}$.

4. Reduce $\frac{46\frac{3}{4}}{48}$ to a single fraction. Ans. $\frac{187}{192}$.

5. Reduce $\frac{73}{131\frac{2}{5}}$ to a single fraction.

$\frac{73}{1}$ $\frac{5}{367}$ $\frac{1}{655}$ $\frac{5}{657}$ Ans. $\frac{365}{657} = \frac{5}{9}$

6. Reduce $\frac{7}{19\frac{3}{5}}$ to a single fraction. Ans. $\frac{35}{98} = \frac{5}{14}$.

7. Reduce $\frac{41}{73\frac{1}{4}}$ to a single fraction. Ans. $\frac{164}{293}$.

8. Reduce $\frac{3}{4\frac{1}{2}}$ to a single fraction. Ans. $\frac{6}{9}=\frac{2}{3}$.

CASE XI. To find the proper quantity of a fraction in the known parts of an integer.

RULE. Multiply the numerator by the known common parts of the integer, and divide the product by the denominator.

EXAMPLES.

1. Reduce $\frac{2}{3}$ of a pound (money) to its proper quantity.

2
20
—
3)40(£0 13 4 Ans.
3
—
10
9
—
1
12
—
3)12(4
12
—

Or thus, by short division.

3)2
———
£0 13 4 Ans.

2. Reduce $\frac{18}{43}$ of a shilling, to its proper quantity.

18
12
—
43)216(5$\frac{1}{43}$d. Ans.
215
—
1

3. Reduce $\frac{9}{16}$ of a pound Troy, to its proper quantity.
Ans. 9 ounces.

4. Reduce $\frac{3}{4}$ of a ton to its proper quantity.
Ans. 15 cwt.

5. Reduce $\frac{6}{7}$ of £5 9, to its proper quantity.

£5 9
6

7)32 14

£4 13 $5\frac{1}{7}$ Ans.

6. Reduce $\frac{4}{5}$ of an Ell English, to its proper quantity. Ans. 1 yard.

7. Reduce $\frac{4}{9}$ of a tun of wine to its proper quantity. Ans. 1 hogshead, 49 gallons.

8. Reduce $\frac{7}{11}$ of 24 hours, to its proper quantity. Ans. 12h. 55 m. 23 seconds, $\frac{1}{11}$.

9. Reduce $\frac{8}{9}$ of a pound Avoirdupois, to its proper quantity. Ans. 8oz. 14dr. $\frac{2}{9}$.

10. Reduce $\frac{4}{7}$ of a mile, to its proper quantity. Ans. 4fu. 22po. 4yds. 2ft. 1in. 2bc. $\frac{1}{7}$.

11. Reduce $\frac{2}{3}$ of a barrel of beer to its proper quantity. Ans. $31\frac{1}{2}$ gallons.

12. Reduce $\frac{3}{8}$ of a chaldron of coals, to its proper quantity. Ans. $13\frac{1}{2}$ bushels.

13. Reduce $\frac{9}{13}$ of 10C. 1qr. 12lb. to its proper quantity. Ans. 8C. 1qr. 25lb. 1oz. $7\frac{3}{11}$dr.

14. Reduce $\frac{7}{8}$ of a yard of cloth, to its proper quantity. Ans. 3qrs. 2na.

15. What is the proper quantity of $\frac{2}{9}$ of a hogshead of beer? Ans. 12 gals.

16. What is the proper quantity of $\frac{3}{16}$ of a barrel of ale? Ans. 6 gals.

17. What is the proper quantity of $\frac{7}{8}$ of an acre of land? Ans. 1 rood, 30 rods.

18. What is the proper quantity of $\frac{12}{16}$ of a pound Troy? Ans. 9oz.

19. Reduce $\frac{3}{5}$ of a dollar to its proper quantity. Ans. 60 cents.

20. What is the proper quantity of $\frac{7}{9}$ of 180 dollars. Ans. $140.

CASE XII. To reduce any given quantity to the fraction of any greater denomination of the same kind.

RULE 1. Reduce the given quantity to the lowest term mentioned, for a numerator.

2. Reduce the integral part to the same term, for a denominator.

Note 1. *If there be a fraction given with the said quantity, add it to the numerator of the fraction required.*

Note 2. *This case and Case XI. prove each other.*

EXAMPLES.

1. Reduce 13s. 4d. to the fraction of a pound (money.)

$$\begin{array}{r} 13 \\ 20 \\ \hline 260 \end{array} \quad \begin{array}{r} 4 \\ \\ \hline \end{array} \qquad \begin{array}{r} 1 \\ 20 \\ \hline 20 \\ 12 \\ \hline 240 \end{array}$$

Ans. $\frac{160}{240} = \frac{2}{3}$.

2. Reduce $5\frac{1}{43}$ pence, to the fraction of a shilling.

$$\begin{array}{r} 43 \\ 5 \\ \hline 215 \\ 1 \\ \hline 216 \end{array} \qquad \begin{array}{r} 43 \\ 12 \\ \hline 516 \end{array}$$

Ans. $\frac{216}{516} = \frac{18}{43}$.

3. Reduce 9 ounces Troy, to the fraction of a pound.

Ans. $\frac{12}{16} = \frac{3}{4}$.

4. Reduce 15 cwt. to the fraction of a ton. Ans. $\frac{3}{4}$.

5. Reduce £4 13 $5\frac{1}{7}$ to the fraction of £5 9.

4 13 $5\frac{1}{7}$	5 9
20	20
93	109
12	12
1121	1308
7	7
7848	9156

Ans. $\frac{7848}{9156} = \frac{6}{7}$.

6. Reduce 1 yard to the fraction of an Ell English.

Ans. $\frac{4}{5}$.

7. Reduce 1 hogshead, 49 gallons, to the fraction of a ton. Ans. $\frac{4}{9}$.

8. Reduce 12 h. 55 m. 23 sec. $\frac{1}{13}$ to the fraction of a natural day. Ans. $\frac{7}{13}$.

9. Reduce 8oz. 14drs. $\frac{9}{5}$, to the fraction of a pound, Avoirdupois. Ans. $\frac{5}{9}$.

10. Reduce 4 fu. 22 po. 4 yds. 2 f. 1 in. 2 bc. $\frac{1}{77}$ to the fraction of a mile. Ans. $\frac{4}{7}$.

11. Reduce $31\frac{1}{2}$ gallons of beer to the fraction of a barrel. Ans. $\frac{7}{9}$.

12. Reduce $13\frac{1}{2}$ bushels of coals to the fraction of a chaldron. Ans. $\frac{3}{8}$.

13. Reduce 8C. 1qr. 25lb. 1oz. $7\frac{3}{11}$ dr. to the fraction of 10C. 1qr. 12lb. Ans. $\frac{8}{11}$.

14. Reduce 3 qrs. 2 na. of cloth, to the fraction of a yard. Ans. $\frac{7}{8}$.

15. Reduce 12 gallons of beer to the fraction of a hogshead? Ans. $\frac{2}{9}$.

16. Reduce 6 gallons of ale to the fraction of a barrel. Ans. $\frac{3}{16}$.

17. Reduce 1 rood, 30 rods of land, to the fraction of an acre. Ans. $\frac{7}{16}$.

18. Reduce 9 ounces Troy, to the fraction of a pound. Ans. $\frac{108}{240} = \frac{12}{16} = \frac{3}{4}$

19. Reduce 60 cents to the fraction of a dollar. Ans. $\frac{60}{100} = \frac{6}{10} = \frac{3}{5}$.

20. Reduce 140 dollars to the fraction of 180 dollars. Ans. $\frac{140}{180} = \frac{14}{18} = \frac{7}{9}$.

Addition of Vulgar Fractions.

Reduce the fractions (given to be added together) to their lowest terms by Case I.

If they are of different denominations, reduce them to a common denominator by Case II.

Add all the numerators together, for a new numerator, under which write the common denominator.

Note. This rule may be proved by subtraction, when only two fractions are given to be added.

Examples.

1. Add $\frac{1}{2}$ and $\frac{7}{8}$ together.

1	7	8
2	2	2
2	14	16

8

16)22(1$\frac{6}{16}$ Ans.

16

6

2. Add $\frac{7}{10}$, $\frac{11}{12}$, and $\frac{4}{5}$, together. Ans. $2\frac{66}{100}$.
3. Add 19, 7, and $\frac{1}{2}$ of $\frac{2}{3}$ together. Ans. $26\frac{2}{6}$ or $26\frac{1}{3}$.
4. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{2}{3}$ of $\frac{19}{20}$ together. Ans. $1\frac{68}{960}$.
5. Add $\frac{1}{2}$ of 95 and $\frac{7}{8}$ of 14 together. Ans. $59\frac{3}{4}$
6. Add $\frac{2}{3}$ and $17\frac{1}{2}$ together. Ans. $18\frac{1}{6}$.
7. Add together $12\frac{1}{2}$, $3\frac{2}{3}$, and $4\frac{1}{4}$. Ans. $20\frac{22}{24}$.
8. Add $6\frac{7}{8}$ of $\frac{9}{10}$, $\frac{4}{7}$ of $\frac{1}{2}$, and $7\frac{1}{2}$ together. Ans. $14\frac{1284}{2240}$.

Note. In the following questions the given fractions must be reduced to their proper quantities by Case XI. in Reduction of Vulgar Fractions, and then added as in Compound Addition.

9. Add $\frac{7}{8}$ of a pound to $\frac{3}{4}$ of a shilling.

1	1	17s. 6d.
20	12	+ 9
20	12	18 3 Ans.
7	3	
8)140	4)36	
17 6	9	

10. Add $\frac{3}{4}$ of a penny to $\frac{1}{5}$ of a pound. Ans. 2s. $3\frac{1}{4}$d. $\frac{6}{25}$.
11. Add $\frac{1}{3}$ a pound Troy to $\frac{7}{12}$ of an ounce. Ans. 6 oz. 11 dwt. 16 gr.
12. Add $\frac{4}{7}$ of a ton to $\frac{9}{10}$ of an cwt. Ans. 12 cwt. 1 qr. 8 lb. 12 oz. 12 dr. $\frac{6}{10}$.
13. Add $\frac{3}{4}$ of a mile to $\frac{7}{10}$ of a furlong. Ans. 6 fu. 28 po.
14. Add $\frac{1}{4}$ a yard to $\frac{2}{3}$ of a foot. Ans. 2ft. 2in.
15. Add $\frac{4}{5}$ of a chaldron of coals to $\frac{7}{8}$ of a bushel. Ans. 16 bush. $3\frac{1}{2}$ pecks.

Subtraction of Vulgar Fractions.

When a vulgar fraction is given to be subtracted from another given one.

1. If they are of different denominations, or in high terms, reduce them as directed in Addition of Vulgar Fractions.

2. Subtract the lesser numerator from the greater, and under the remainder place the common denominator.

Note 1. *When whole numbers are given with fractions, the lower numerator will sometimes be the greatest, in which case subtract it from the denominator, and to the remainder add the upper numerator, and carry one to the unit's place of the lower whole number.*

Note 2. *This rule is proved by addition.*

EXAMPLES.

1. From $\frac{111}{112}$ take $\frac{3}{4}$.

111	3	112
4	112	4
444	336	448
336		
108		

Ans. $\frac{108}{448} = \frac{27}{112}$.

2. From $96\frac{1}{3}$, take $14\frac{3}{7}$.

1	3	7
7	3	3
7	9	21

$96\frac{7}{21}$
$14\frac{9}{21}$
$81\frac{19}{21}$ Ans.

3. From $14\frac{1}{4}$ take $\frac{2}{3}$ of 19. Ans. $1\frac{7}{12}$.
4. From $\frac{297}{100}$ take $\frac{3}{4}$. Ans. $\frac{372}{400}$.
5. From 96 take $\frac{3}{5}$. Ans. $95\frac{2}{5}$.
6. From $\frac{1}{3}$ of 76, take $\frac{3}{4}$ of 21. Ans. $9\frac{7}{12}$.
7. From $\frac{109}{110}$, take $\frac{1}{2}$ of $\frac{2}{3}$, of $\frac{3}{4}$. Ans. $\frac{19536}{26640} = \frac{163}{222}$.
8. From $71\frac{1}{3}$ take $\frac{17}{18}$. Ans. $70\frac{23}{36}$.

Note. In the following examples the given fractions must be reduced to their proper quantities, and then subtracted as in Compound Subtraction.

9. From $\frac{1}{2}$ of a pound (money) take $\frac{3}{4}$ of a shilling.

1	1	10s. 0d.
20	12	9
2)20	12	9 3 Ans.
10s.	3.	
	4)36	
	9d.	

10. From $\frac{1}{4}$ a shilling take $\frac{2}{3}$ of a penny. Ans. $5\frac{1}{3}$d.

11. From $\frac{2}{3}$ of an ounce Troy take $\frac{7}{8}$ of a penny weight. Ans. 11dwt. 3gr.

12. From $\frac{1}{2}$ cwt. take $\frac{7}{12}$ of a pound.
Ans. 1 qr 27 lb. 6oz. 10 dr. $\frac{8}{12}$.

13. From $\frac{2}{3}$ of a league take $\frac{7}{10}$ of a mile.
Ans. 1m. 2fu. 16po.

14. From 1 Ell English, take $\frac{2}{10}$ of a yard.
Ans. 2 qr. 0 na. $\frac{8}{10}$.

15. From $\frac{3}{12}$ of a hogshead of beer take 1 gallon.
Ans. $12\frac{1}{2}$ gallons.

16. From $\frac{4}{5}$ of a chaldron of coals take $\frac{2}{3}$ of a bushel.
Ans. 17 bu. $1\frac{1}{3}$ peck.

Multiplication and Division of Vulgar Fractions.

1. Prepare the given fraction by reduction (if necessary) by reducing them to their lowest terms, if mixed fractions, reduce to single ones.

2. Multiply the numerators together for a new numerator.

3. Multiply the denominators together for a new deminator.

Note. When any number, either whole, fractional, or mixed, is multiplied by a fraction, the product will be less than the multiplicand, in the same proportion as the multiplying fraction is less than 1, *or an unit.*

In Division of Vulgar Fractions prepare the given fractions (if necessary) as for multiplication; then invert

the divisor, i. e. place its denominator for its numerator, or uppermost, and its numerator lowermost, and then proceed as in multiplication, by multiplying the two uppermost, or those now in the place of numerators together, for a new numerator, then multiply the two lowermost together for a new denominator.

Note. When mixed numbers are given to be divided, as pounds, shillings, and pence, hundreds, and quarters, &c.

Reduce the dividend and divisor to the lowest denomination mentioned, and to a common denominator, then divide this reduced numerator of the dividend by the reduced numerator of the divisor, and under the quotient place the common denominator, or invert the reduced divisor, and then multiply as above directed, the result will be the quotient in a fraction of the highest denomination mentioned.

*Note. Multiplication and Division of Vulgar Fractions, prove each other.**

EXAMPLES.

1. Multiply $\frac{3}{7}$ by $\frac{3}{11}$.

$$\begin{array}{rr} 3 & 11 \\ \times\ 3 & \times\ 7 \\ \hline = 9 \text{ numerator.} & 77 \text{ denominator.} \end{array}$$

Ans. $\frac{9}{77}$.

2. Divide $\frac{9}{77}$ by $\frac{3}{11}$.

$$\frac{1\,1}{7})\frac{9}{77}(\frac{9\,9}{2\,3\,1} = \frac{3}{7}.$$

Ans. $\frac{3}{7}$.

* When fractions only are divided by fractions only, then if the dividend is greater than the divisor, the quotient will be greater than the dividend, but if the dividend is less than the divisor, the quotient will be less than the dividend, and in the same proportion as an unit or 1, is greater or less than the divisor.

3. Multiply $\frac{3}{5}$ of 8, by $\frac{7}{8}$ of 5.

$\frac{3}{5}$	of	$\frac{8}{1}$	$\frac{7}{8}$	of	$\frac{5}{1}$
8		5	7		8
3		1	5		1
24		5	35		8

Reduced is $\frac{24}{5}$ by $\frac{35}{8}$.

24	5
35	8
120	40
72	
840	

Ans. $\frac{840}{40}=21$.

4. Divide 21 by $4\frac{4}{5}$.

$4\frac{4}{5}$
5

$= \frac{24}{5}$ then $\frac{21}{1}$ by $\frac{24}{5}$ thus,
$\frac{5}{24})\frac{21}{1}(\frac{105}{24} = \frac{35}{8}$, of $4\frac{3}{8}$, or $\frac{7}{8}$ of 5.

5. Multiply $\frac{4}{9}$ by $\frac{7}{9}$. Ans. $\frac{28}{81}$.
6. Divide $\frac{28}{81}$ by $\frac{7}{9}$ Ans. $\frac{252}{504} = \frac{4}{8} = \frac{1}{2}$.
7. Multiply $\frac{1}{7}$ of $\frac{4}{3}$, by $\frac{7}{10}$ of $\frac{11}{12}$.
Ans. $\frac{308}{4200}=\frac{77}{1050} = \frac{11}{150}$.
8. Divide $\frac{11}{150}$ by $\frac{7}{10}$ of $\frac{21}{12}$. Ans. $\frac{1320}{11550} = \frac{1}{7}$ of $\frac{4}{3}$.

This may be proved thus, $\frac{1}{7}$ of $\frac{4}{3}$ reduced is $\frac{4}{35}$, therefore divide the numerator 1320 by 4, the quotient will be 330; divide the denominator 11550 by 35, the quotient will also be 330, this proves $\frac{1320}{11550}$ to be equal to $\frac{4}{7}$ of $\frac{4}{5}$, and proves example 7th to be done right.

9. Multiply $4\frac{1}{2}$ by $\frac{1}{8}$. Ans. $\frac{9}{16}$.
10. Multiply $\frac{1}{2}$ of 7, by $\frac{1}{8}$. Ans. $1\frac{9}{16}$.
11. Divide $\frac{9}{16}$ by $\frac{1}{8}$. Ans. $4\frac{1}{2}$.
12. Divide $1\frac{9}{16}$ by $\frac{3}{5}$. Ans. $3\frac{1}{2} = \frac{1}{2}$ of 7.

13. Multiply 6s. 9d. by 9s. 6d.

6 9 9 6
12 12
81 114
12 12
114 144
81
114
912
(2|0 s.
144)9234(6|4
864
£3 4 1½ Ans.
594
576
18
12
216(1
144
72
4
288(2
288

14. Multiply £3 19 11 ¼, by itself.
Ans. £15 19 10 $\frac{230}{576}$.

15. Divide £3 4 1½ by 9s. 6d. Ans. 6s. 9d.

Rule of Three, or Proportion in Vulgar Fractions.

1. Prepare the first and third terms as directed in Addition of Vulgar Fractions; if more than three terms are given, prepare all but the middle term as above.

2. If the middle term is a compound or a mixt fraction, reduce it to a single fraction, and to its lowest term.

3. In stating, use the numerators only, and proceed with them as with whole numbers, the result will be the numerator of the quotient, or answer, whose denominator is the same as that to which the middle term was reduced.

Note. These examples may be proved by varying their order.

EXAMPLES.

1. If $\frac{3}{4}$ of a yard of cloth cost $\frac{7}{8}$ of a dollar, how much will $\frac{1}{2}$ a yard cost?

$\frac{3}{4} : \frac{7}{8} :: \frac{1}{2}$

3 1
2 4

6 : 7 :: 4
4

6)28($\frac{4}{6}$ Ans. which reduced by Case X, will be $\frac{7}{12}$ of a dollar, for the answer.
24
4

2. If $\frac{4}{5}$ of a ton of hay cost $16, how much will $\frac{9}{10}$ of a ton cost? Ans. $18.

3. If $\frac{1}{4}$ of a hogshead of wine cost $30, what will $\frac{1}{6}$ cost? Ans. $5.

4. If $\frac{1}{8}$ of a hogshead of wine cost $5, what is it a hogshead? Ans. $40.

5. If $\frac{7}{8}$ of a yard of painting cost $\frac{4}{10}$ of a dollar, what is it a yard? Ans. $4\frac{36}{70} = \frac{324}{720} = \frac{81}{180} = \frac{9}{20}$ or 45 cents.

6. If 1 yard of paint cost 45 cents, what will $\frac{8}{9}$ of a yard cost? Ans. 40 cents, $= \frac{4}{10}$ of a dollar.

Note. The 5 and 6 examples prove each other by varying their order.

7. If $\frac{7}{8}$ of a dollar be worth $5\frac{1}{4}$ shillings, how much of the same currency is $32\frac{5}{10}$ dollars worth?

Ans. $\frac{780}{7}$ of a shilling, which reduced to its proper quantity is £9 15.

EXTRACTION OF THE SQUARE ROOT.

The square root of any number is that number which being multiplied by itself* will produce the number of which it is called the square root, and the number so produced is called its square.

The square root of a given number is found as follows: viz.

Begin with the unit figure, and place a point over it, then proceed towards the left, pointing every second figure, as is done with the example below; each two figures are called a period.

If there are decimals, proceed towards the right from the unit figure, pointing every second figure: should a place be wanting in the decimals, supply it with a cipher.

The figure under the left hand point and that to the left of it (if any) is the first resolvend.

Find such a figure as, being involved to the second power,† will come the nearest to this resolvend, and not exceed it.‡

Place the number thus found under the resolvend, and subtract it therefrom; and place the figure, so involved, in the quotient or root; to the remainder bring down two figures, or the next period, placing them at the right of it, for a new resolvend; draw a crooked stroke or line at the left of this new resolvend.

Double the quotient, and place it for a divisor at the left of the new resolvend, leaving room for more figures at the right of this divisor.

See how often this divisor is contained in the resolvend, excluding its right hand figure, allowing for the

* By some called involving the number to the second power, &c. thus $4 \times 4 = 16$, the square of 4, or 4 involved to the second power; also $4 \times 4 \times 4 = 64$, the cube of 4; or 4 involved to the third power.

† Multiplied by itself.

‡ This is called a subtrahend.

increase in multiplying the divisor, with the figure thus found annexed to it, by said figure.

Place this figure in the quotient, and also at the right of the divisor.

Multiply the divisor (thus increased) by this last figure in the quotient, the product will be the subtrahend to place under the resolvend, to be subtracted therefrom.

To the remainder bring down another period, and proceed as before, till the work is completed.

Note. The number of points over the given square, shows how many figures there will be in the root.

These examples are proved by multiplying the root by itself, and if any remain take it in, or add it to the product, as in proving division, the result will be equal to the first given number.

Examples.

1. What is the square of 12 ?

12 The number 12 multiplied
12 by itself produces its square.

144 Ans.

2. What is the square root of 144 ?

144(12 Ans.
1

22)44
44

In this example I find that 1 is the highest number to place in the root or quotient, as the left hand period is 1, which I place both in the quotient, and under that period, and subtract it from the period, find none remains ; I then bring down the next period 44, and double the quotient for a divisor, to find a second figure

of the root; this divisor 2 I can have twice in 4, (omitting the right hand figure in the resolvend) I set 2 in the quotient or root, and also at the right of the divisor, then I multiply the divisor thus increased, by this last figure in the root, and set the product under the resolvend, for a subtrahend, and subtract it therefrom; and as there are no more periods to bring down, the work is done; and as there is no remainder, the root is a perfect one.

3. What is the square of 345?

345
345
1725
1380
1035
119025 Ans.

4. What is the square root of 119025?

119025(345 Ans.
9
64)290
256
685)3425
3425

Note 1. The figure found by dividing all but the right hand figure in the resolvend, will sometimes prove too great on account of the increase, by multiplying it with the other figures in the divisor; in which case a less number must be taken, so as the product may not exceed the resolvend.

Note 2. When there is a remainder after extracting the square root from the last resolvend, and a more exact root is required, annex two ciphers to the remainder, and proceed as before; if there be another remainder, annex two ciphers to it, and proceed on to as many places of figures as you please.

Note 3. All figures found in the root after annexing ciphers, will be decimals.

5. Required the square root of 1739.

1729(41,581+ Ans. 41,581
16 41,581

81)189 41,581
81 332648
207905
825)4800 41581
4125 166324
Remainder, 20439

8298)67900 Proof, 1729,000000
66464

83161)103600
83161

20439

Note. Double the square root is the denominator of the remaining fraction, thus, $\frac{20439}{83161}$.

6. Required the square root of 1296? Ans. 36.
7. What is the square root of 360000? Ans. 600.
8. What is the square root of 157641? Ans. 371.
9. Required the square root of 123692,89. Ans. 351,7.
10. Required the square root of 138387. Ans. 372+.
11. What is the square root of 398326? Ans. 639+.

12

The square root is useful in geometry, measuring of superficies, surveying, &c.

12. A surveyor is required to lay out 1000 acres of land, in form of a square, how many rods will be the length of each side? Ans. 400 rods.

Note. The 12 example is solved by reducing the acres to rods, and then extracting the square root of those rods.

13. There is a ditch 20 feet wide, full of water, on one side of the ditch is a wall 15 feet high from the

water; it is required to make a ladder that will just reach the top of the wall from the opposite side of the ditch; how long must it be? Ans. 25 feet.

To find the length of the ladder, add the square of the width of the ditch, and the square of the heighth of the wall together, and extract the square root of their sum.

To extract the square root of a vulgar fraction.

RULE. Reduce the fraction to its lowest term, then extract the square roots of the numerator, and also of denominator, and set them down fractionwise, it will be the root required.

NOTE. The same rule holds good for extracting the cube or any other root of a vulgar fraction.

EXAMPLE.

1. Required the square root of $\frac{125}{405}$.

5)$\frac{125}{405}$($\frac{25}{81}$ lowest terms.
25)5 root of the numerator.
25

81)0 root of the denominator.
81

Ans. $\frac{5}{9}$.

EXTRACTION OF THE CUBE ROOT.

The cube root of a number is that number, which if multiplied by itself, and that product multiplied by the first number, the second product will be the cube, or number of which the cube root is required.

The given number must be prepared for extraction by placing a point over the unit figure, and every third figure each way from it, so as to have periods of three figures each.

There will be the same number of figures in the root, as there are periods, either of whole numbers, or of decimals.

When there are decimals given, and do not make complete periods of three figures each, annex ciphers sufficient to complete the right hand period.

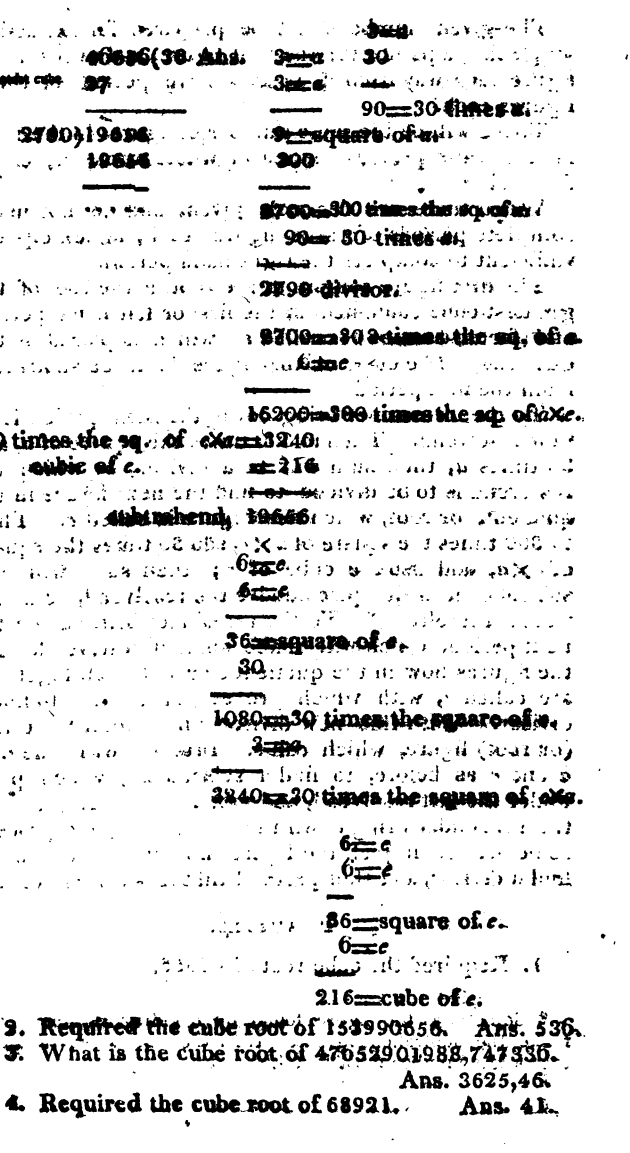
The first figure sought in the root, is the root of the greatest cube contained in the first or left hand period, and (for dissimation) is called a, which is placed in the quotient. The cube of this figure is to be subtracted from the first period.

To the remainder bring down the next period for a new resolvend. Then to 300 times the square of a, add 30 times a, their sum will be a divisor, by which the resolvend is to be divided to find the next figure in the quotient, or root, which next figure is called e. Then to 300 times the square of $a \times e$, add 30 times the square of $e \times a$, and also the cube of e; their sum will be a subtrahend, which place under the resolvend, and subtract it therefrom.* To the remainder bring down the next period, which will make another resolvend. All the figures now in the quotient or root (taken together) are called a, with which proceed as before, to find a divisor. With this new divisor find another quotient (or root) figure, which call e. Proceed with the new a and e as before, to find a subtrahend, which place under the last resolvend, and subtract it therefrom. To the remainder bring down the next period, and proceed as before, calling all the figures now in the root a, to find a divisor, and thus proceed till the work is done.

Examples.

1. Required the cube root of 46656.

* Sometimes the figure found by dividing as above will make the subtrahend greater than the resolvend, in which case a less number must be taken as in the square root.



2. Required the cube root of 153990656. Ans. 536.
3. What is the cube root of 47652901988,747336. Ans. 3625,46.
4. Required the cube root of 68921. Ans. 41.

5. Required the cube root of 262,144. Ans. 6,4.
6. Required the cube root of 69426,531. Ans. 41,1.
7. Required the cube root of ,000729. Ans. ,09.
8. What is the cube root of ,000000343 ? Ans. ,007.

A general rule for extracting the roots of all powers.

1. Prepare the given number for extraction, by pointing off from the unit place, as the root required directs.

2. Find the first figure in the root by your own judgment, or by inspection into the table of powers.

3. Subtract it from the given number.

4. Augment the remainder by the next figure in the given number, that is, by the first figure in the next point, and call this your dividend.

5. Involve the whole root last found, into the next inferior power to that which is given.

6. Multiply it by the index of the given power, and call this your divisor.

7. Find a quotient figure by common division, and annex it to the root.*

8. Involve all the root, thus found, into the given power.

9. Subtract this power (always) from as many points of the given power as you have brought down, beginning at the lowest place.

10. To the remainder bring down the first figure of the next point for a new dividend.

11. Find a new divisor as before, and in like manner proceed till the work is ended.

EXAMPLES.

1. What is the cube root of 11550,1303?

* This must sometimes be taken less than the divisor would give, as is often the case in the square and cube roots, by the other method, so as to have the involved root, not exceed the resolvend.

115501303(487 Ans.
64

660)5115 dividend.

110592 subtrahend.

6912)49093 dividend.

115501303 subtrahend.

0

4× 4× 3=48 divisor.
48× 48× 48=110592 subtrahend.
48× 48× 3=6912 divisor.
487×487×487=115501303 subtrahend.

2. What is the biquadrate root of 56249134561 ?*

56249134561(487 Ans.
256

256)3064 dividend.

5308416 subtrahend.

442368)3164974 dividend.

56249134561 subtrahend.

0

4× 4× 4× 4=256 divisor.
48× 48× 48× 48=5308416 subtrahend.
48× 48× 48× 4=442368 divisor.
487×487×487×487=56249134561 subtrahend.

* The most simple method of extracting the biquadrate root is to extract the square root of the given number, and then extract the square root of the square root thus found; this second square root will be the biquadrate root of the given number.

MISCELLANEOUS QUESTIONS.

1. I demand the sum of 1738, added to itself.
Ans. 3476.

2. What is the difference between 14676, and the fourth of itself?
Ans. 11007.

3. Required the product of 365, multiplied by itself.
Ans. 133225.

4. Admit 476 be the square root of a number, what will be the quotient of that number, divided by half its root?
Ans. 952.

5. There is in three bags the sum of $1468, viz. in the first bag $461, in the second, $581; how much is in the third bag?
Ans. $426.

6. What number is that which if multiplied by 17, the product will be 221?
Ans. 13.

7. A and B owes several debts, the less debt being that of A, is $2173, the difference of the two is $371; what is B's debt?
Ans. $2544.

8. A captain and 160 sailors took a prize worth $4583, of which the captain had $\frac{1}{5}$ for his share, and the rest was equally divided among the sailors; what was each man's part?

Ans. { The captain had $906,40.
each sailor, 22,66.

9. What number is that from which if you take 726, the remainder will be 340?
Ans. 1066.

10. What number is that which being added to 706, their sum will be 1538?
Ans. 832.

11. What number is that which being divided by 72, the quotient will be 19?
Ans. 1368.

12. If stock be bought when it is worth $650 per cent. and sold again when it is worth $130 per cent. how much is lost in buying and selling $400 capital stock?
Ans. $2080.

13. A man at the age of 25 years had a son born, who lived 46 years; and then died; after which time the father lived 17 years abroad, and 23 years at home, and then died also; what was the age of the father when he died?
Ans. 111 years.

14. Three men traded in company till they gained £120; the sums they put in were in such proportion, that as often as A had £5 of the gain, B had £7, and as often as B had £4, C had £6; what was each man's share of the gain?

Ans. A, £26 13 4
B, 37 6 8
C, 56 0 0

15. A, B and C, freight a ship with goods to the value $11088, of which A put in $1107, B $2691, by reason of a storm, one third of the goods were lost; what was C's share of the first cost, and each man's share of the loss?

Ans. C's share of cost $7290.

Shares of the loss. A's $369
B's 897
C's 2430

16. A and B traded in company, and gained $100; A put in $640, B put in so much that he must receive $60 of the gain; I demand how much B put in?

Ans. $960.

17. What is the value of 27 dozen and 10 pounds of candles, at 5d. per lb? Ans. £6 19 2.

18. Bought 28 quarters, and 2 bushels of wheat, at 4s. 6d. per bushel; what is its whole value?

Ans. £50 17.

19. How much can a man earn in 20 weeks, at 75 cents per day, Sundays excepted? $Ans. 90.

20. A, B and C, traded together, A put in I know not how much, B put in 20 pieces of cloth, and C put in $500, and they gained $1000, whereof A ought to have $350, and B $400; what was C's share of the gain, how much did A put in, and how much was B's cloth worth?

Ans. C's share of the gain was $250.
A put in $700.
B's cloth was worth $800.

21. A merchant bought six bags of hops, weighing as follows, viz. No. 1, 3cwt. 3qrs. 20lb; No. 2, 3cwt. 2qrs. 26lb; No. 3, 3cwt. 24lb; No. 4, 3cwt. 3qrs. No. 5, 2cwt. 2qrs. 22lb; No. 6, 2cwt. 2qrs. 26lb; besides 5 packets, three of which weighed 76½lb. each, and the other two 62¼lb. each; what is the weight of the whole? Ans. 22cwt. 0qrs. 24lb.

22. Two merchants in company gained $1000; A put in so much that his share of the gain was $600; B put in 7200 ducats, at ⅓ of a dollar each; I demand how much A put in, and how much the ducats were worth? Ans. A put in $3600, and B's ducats were worth $2400.

23. If ¼ of 8, be 3, what will ⅓ of 20 be? Ans. 10.

24. If I buy an apple and an half, for 3 half cents, how many can I buy for a dollar? Ans. 100.

25. A man bought a certain quantity of broadcloth and drugget, which cost him £81; there were 50 yards of the broadcloth, at 18s. per yard, and for every 5 yards of broadcloth he had 9 yards of drugget; I demand the number of yards of drugget, and how much it was p er yard? Ans. 90 yards at 8s. per yard.

26. What is the difference between six dozen dozen, and half a dozen dozen? Ans. 792.

27. An usurer lent £90 for 12 months, and at the end of the time received £95 8, for principal and interest; I demand at what rate per cent. he received interest? Ans. 6 per cent.

28. Two men travel in opposite directions, from one place at the same time, one travels 7, the other 11 miles a day, for 12 days; how far are they asunder, at the end of the 12th day? Ans. 216 miles.

29. Two men depart from one place at the same time, and both travel the same road, one travels 12, the other 17 miles, each day, for 10 days; how far are they then asunder? Ans. 50 miles.

30. A man's yearly income is $1913,12½; how much may he spend per day, to lay up $4000 at the end of four complete years of 365 days, 6 hours each?

Ans. $2,50.

31. A square piece of land contains 43560000 superficial feet; what is the length of one of its sides?

Ans. 6600 feet.

32. Two men set out at the same time, from the same place, but go contrary ways: In what time will they be 2000 miles asunder, each traveling 34 miles a day, allowing 12 hours to each day?

Ans. 29 days, 4 hours, 56 minutes, $28\frac{4}{34}$ seconds.

33. There are three numbers, 17, 19, and 48; I demand the difference between the sum of the squares of the first and third, and the cube of the second?

Ans. 4266.

34. In 7 cheeses, each weighing 1cwt. 2qrs. 5lb. how many allowances for seamen may be cut, each weighing 5oz. 7dr.? Ans. $3563\frac{5}{11}$.

35. In 81084 runlets of brandy, each 18 gallons, how many gross of bottles, each bottle $\frac{8}{9}$ of a quart?

Ans. 46581 gross, 7 dozen and 6 bottles.

36. A gentleman a chaise did buy,
A horse and harness too:
They cost the sum of three score pounds,
Upon my word 'tis true;
The harness came to half the horse,
The horse to twice the chaise,
And if you'll tell the price of each,
Take them and go your ways.

Ans. { Harness, £15.
Horse, 30.
Chaise, 15.

37. There are two numbers, the one 25, the other the square of 25; I demand the square root of the sum of their squares. Ans. $625,4998\frac{1}{2}$.

38. What will be the freight of 3 boxes, measuring; No. 1, $7\frac{1}{2}$ feet long, 3 feet 9 inches wide, and 1 foot 3 inches deep; No. 2, 5 feet 3 inches long, 4 feet wide, and $3\frac{1}{2}$ feet deep; No. 3, $4\frac{1}{2}$ feet long, 3 feet wide, and $2\frac{1}{2}$ feet deep, at $1,25 per foot? Ans. $177,91+.

39. The ceiling over a store is $51\frac{1}{2}$ feet long, and 23 feet, 1 inch wide; how much must I pay for plastering it, at 25 cents a yard? Ans. $33,01,7\frac{1}{12}$.

40. A merchant bought 8 tuns of wine, which having received damage, he sold for £400, and 12 per cent. loss; I demand how much it cost him per tun, and how he sold it per gallon, to lose after the said rate?

Ans. { Cost £56 16 $4\frac{4}{11}$ $\frac{1}{11}$ per tun.
Sold at 0 3 $11\frac{1}{2}$ $\frac{60}{2016}$ per gallon.

41. What number is that which being multiplied by $\frac{4}{7}$, the product will be $15\frac{1}{4}$. Ans. 21.

42. What number is, that which being divided by $\frac{4}{7}$, the quotient will be 21. Ans. $15\frac{1}{4}$.

43. What number is that from which if you take away $\frac{2}{5}$ of itself, the remainder will be 42? Ans. 70.

44. What number is that which being multiplied by $\frac{2}{3}$, the product is $\frac{1}{4}$? Ans. $\frac{3}{8}$.

45. What part of 25 is $\frac{4}{5}$ of an unit? Ans. $\frac{1}{20}$.

46. What number is that of which 9 is $\frac{2}{3}$? Ans. $13\frac{1}{2}$.

47. If a cannon may be discharged twice with 6lb. of powder, how many times will 7 cwt. 3 qrs. 17 lb. discharge the same? Ans. 295 times.

48. If $\frac{5}{8}$ of a ship be worth £3740, what is the whole worth? Ans. £9973 6 8.

49. A young man received $210, which was $\frac{1}{3}$ of his elder brother's portion; and three times the elder brother's portion was half of the father's estate; I demand how much the estate was? Ans. £1890.

50. Shipped in Spain 10 tuns of wine, at $40 per hogshead; lost 1 pipe (by its staving,) sold the rest for $66 per hogshead, paid freight $80, other expenses $90; did I gain or lose, and how much? Ans. gained $808.

51. If tallow be sold for 4d. per pound, what is the value of 3 tubs, each 3cwt. 1qr. 10lb. gross; tare per tub 25lb? Ans. £17 9.

52. What is the amount of 1000 dols. for $5\frac{1}{2}$ years, at $4\frac{1}{2}$ per cent. per annum? Ans. $1247,50.

53. Sold goods to the amount of 1000 dols. to be paid half at 4, and the rest at 8 months; what must be discounted for present payment, at 6 per cent. per annum? Ans. $29,80,$\frac{5588}{10000}$.

54. What is the present worth of 5000 dols. payable half at 4 months, the rest at 8, allowing discount at 6 per cent. per annum? Ans. $4954,82 $\frac{6944}{10000}$.

55. A merchant sent to Spain 400 parcels of something, (no matter what) at £12, each parcel clear of expenses, and in return received one half in wine, at £30 per tun; the other half in rice, at £1 8 per cwt; how much had he of each? Ans. 80 tuns of wine, and 1714cwt. 1qr. 4lb. of rice.

56. There are two numbers, the one 63, the other half as much, I demand the difference of their product and sum; also the product of their squares.

Ans. { Difference of their product and sum, =1890.
Product of their squares, =3938240,25.

57. There are two numbers, their product is 1008, and multiplicand 46; I demand the multiplier, the sum of the factors, and the difference between the sum of the cubes of the factors, and the square of the product.

Ans. { Multiplier, 28. Sum of the factors, 69. Difference between the cubes of the factors, and square of the product, 1009851.

58. What is the value of 64 hogsheads of lime, at $2,50 per hogshead? Ans. 210 dols.

59. Bought 84 hogsheads of lime for 210 dols. what was it per hogshead? Ans. dols. 2,50.

60. What is the value of 936 barrels of tar, at dols. 3,25? Ans. 3042 dols.

61. If 936 barrels of tar cost 3042 dols. what was it per barrel? Ans. dols. 3,25.

62. What is the value of 643 acres, 3 roods, and 20 poles of land, at 8 dols. per acre? Ans. 5151 dols.

63. If 643 acres, 3 roods, 20 poles of land, cost 5151 dols. what is it per acre? Ans. 8 dols.

64. Bought a yoke of oxen valued at 75 dols. paid 25 dols. and gave a note for the remainder, payable in two years, with interest at 6 per cent. per annum, simple interest; what will be the amount of the note, at the expiration of the time? Ans. 56 dols.

65. What is the amount of 5236 dols. being at simple interest for 4½ years, at 6 per cent. per annum?

Ans. dols. 6728,26.

66. What sum will amount to dols. 6728,26, in 4½ years, at an interest of 6 per cent. per annum?

Ans. 5236 dols.

67. Sold 1000 bushels of wheat, at one dollar per bushel, took half the value in money, the remainder in Indian corn, at ⅔ of a dollar per bushel; how much corn did I receive? Ans. 750 bushels.

68. Bartered a pipe of wine containing 126 gallons, at 60 cents per gallon, for brandy at 75 cents per gallon; how much brandy had I for the wine? Ans. 84 gals.

69. What is the value of £9736 sterling in the currency of New England? Ans. £12981 6 8.

70. Change £12981 6 8, New England currency, to sterling. Ans. £9736.

71. Six robbers, viz. A, B, C, D, E and F, entered into a confederacy, and agreed to divide their booty in proportion to their valour, i. e. in proportion to the number of scars they should have to shew; the first two, A and B, being very bold, had received, A 20, and B 19 scars; the next two, C and D, being somewhat timid, received each 9 scars, but the other two, E, and F, being mere cowards, received each one scar; and have at several times robbed to the amount of 1180 dols. how much must each have?

Ans. A, $400.
B, 380.
C, 180.
D, 180.
E, 20.
F, 20.

72. In 731 dozen bottles of wine, each $1\frac{4}{7}$ pints, how many hogsheads? Ans. 29 hogsheads, 52 galls. $5\frac{5}{7}$ pts.

73. Sold goods which cost me 3500 dols. at 25 per cent. loss; how much did I receive for them?

Ans. 2625 dols.

74. Sold goods for 2625 dols. at 25 per cent loss, what did they cost me? Ans. 3500 dols.

75. Add 3 times 3, and 9 times 9, and 4 times 4 and 7, to 6 times 6, and 8 times 8, and 20 and 11. Ans. 344.

76. If 20 dogs for 30 groats,
Goes 40 weeks to grass,
How many hounds, for 15 pounds,
May winter in that place? Ans. $1846\frac{6}{13}$.

77. If 48 taken from 120, leaves 72, and 72 taken from 91 leaves 19, and 7 taken from 19 leaves 12, what number is that from which if you take 48, 72, 19 and 7 leaves 12? Ans. 158.

78. A hath $\frac{1}{2}$ a ship, B $\frac{1}{3}$, C $\frac{1}{12}$, and D $\frac{3}{20}$; the master clears 120 dols. how much of this sum must each owner have?

Ans. A, $60.
B, 30.
C, 7,50.
D, 22,50.

79. A man has 50s. to pay among his labourers, for a day's work; they consisted of an equal number of men women and boys; to the boys he gave each 6d. to each

woman 8d. and to each man 16d; how many were there of each? Ans. 20 of each.

80. A man has £7 17 6, to pay among his labourers, being men, women and boys; to each boy he gave 6d. to each woman 8d. and to each man 16d. there were for every boy 3 women, and for every woman 2 men; I demand the number of each?

Ans. 15 boys, 45 women, and 90 men.

81. There are 1000 dols. to be divided among three men, in such proportion that as often as A has 3 dols. B shall have 5 dols. and C 8 dols; how much must each have?

Ans. A, dols. 187,50.
B, 312,50.
C, 500.

82. Admit a town is taxed £39 for the building a bridge, the town rent is £900 per annum; what must a man (of that town,) pay towards it, whose income is £100 per annum? Ans. £4 6 8.

83. Suppose A pays 5s. 10d. for an income of £68 per annum, what must B pay, whose income is £100 per annum? Ans. £8 11 0$\frac{4}{17}$.

84. Divide 1400 dols. between A and B, so as that A's share shall bear such proportion to B's, as 2 to 5.

Ans. A, 400 dols.
B, 1000

85. Shipped 550 pair of stockings, at 75 cents per pair; 460 yards of stuff, at 25 cents per yard; in return for which I had 30 cwt. 3 qrs. of sugar, at 5 dols. per cwt; now, admitting advance on the stockings and stuffs, was just sufficient to defray all expenses, how much have I to receive of this adventure?

Ans. dols. 378,75.

86. If four pounds ten, and forty groats,
Will buy a load of hay,
How many pounds, with nine French crowns,
For twenty loads will pay? Ans. £100 7 3$\frac{3}{10}$.

Note. This last example is considered as New England currency, where pounds, &c. are expressed.

87. A grocer laid out for spices, £560, at the following prices, viz. cloves at 4s. per lb. mace at 7s. cinnamon at 3s. nutmegs at 12s. and pepper at 2s. per lb. and had of each an equal quantity; how many pounds of each had he? Ans. 400lb. of each sort.

88. Admit the distance from Boston to New York, to be 240 miles; A sets out from Boston for New York, and travels 20 miles a day; after A has travelled 2 days, B sets out from Boston, for New York, and travels 40 miles a day: In what time will each arrive at New York, how far from Boston will B overtake A, and how far will A be behind B, when the latter arrives at New York?

Ans. { A will be 12 days, B, 6 } travelling.
{ A, will be overtaken 80 miles from Boston. will be behind B, 80 miles, when B arrives at New York.

89. Bought 127 pieces of cloth, for which I gave 3589 ells of Holland, at 7s. 11d. per ell; what cost a piece of that cloth? Ans. £11 3s. $8\frac{87}{127}$d.

90. I have laid out for a merchant 4432 dols. for which he allows me 2½ per cent. commission; I owed him 282 dols. how much is he indebted to me?

Ans. dols. 3234,80.

91. Change £536 sterling, to federal money.

Ans. dols. 2382,22$\frac{2}{9}$.

92. Change dols. 2382,22$\frac{2}{9}$, to sterling money.

Ans. £536.

93. Change £536 sterling, to the currency of New England. Ans. £714 13s. 4d.

94. Change £714 13s. 4d. New England currency, to sterling. Ans. £536.

95. Change £714 13s. 4d. New England currency, to federal money. Ans. dols. 2382,22$\frac{1}{9}$.

96. Change dols. 2382,22$\frac{1}{9}$, to New England currency.

Ans. £714 13s. 4d.

97. Bartered 2000 barrels of flour at 6 dols. per barrel, for tar at dols. 3,25 per barrel; how much tar had I for the flour? Ans. 3692$\frac{60}{325}$ barrels.

98. I would ensure an adventure which cost me 9370 dols; how much must I ensure so as to cover both principal and premium, when I pay for ensurance 5 per cent? Ans. dols. 10073,68$\frac{40}{95}$.

99. Bought a tun of wine for dols. 150,54; how must I sell it per quart to gain dols. 33,46; admitting there is 28 gallons lost? Ans. 80 cents.

100. Bought 3 hogsheads of sugar, weighing as follows, viz.

No. 1 gross, 19 cwt. 2qrs. 13lb. Tare 100lb. per hhd.
No. 2 ... 19 ... 1 ... 16.
No. 3 ... 9 ... 3 ... 26.

paid dols. 8,50 per cwt; how must I sell it per hundred to gain dols. 42,46,87 5? Ans. 10 dols.

101. If I buy 1000 ells Flemish of linen, for 400 dols. how must I sell it per yard to gain 50 dols? Ans. 60 cts.

102. If I buy 1000 ells Flemish of linen, and sell the whole at 60 cents per yard, and gain 50 dols. how much did the whole cost me? Ans. 400 dols.

103. If I buy 1000 ells Flemish of linen for 400 dols. how much was it per ell, and how must I sell it per ell, to gain 50 dols? Ans. it cost 40 cents, and must be sold for 45 cents per ell.

104. Bought three score pieces of Holland for three times as many dollars, and sold them again for four times as much; but if they had cost me as much as I sold them for, what must I have sold them for to gain after the same rate? Ans. 2880 dols.

105. My correspondent in London informs me that he has disbursed on my account, £2576 sterling; how much federal money must I pay for him in New York, to requite his kindness? Ans. dolls. 11448,88$\frac{8}{9}$.

106. My correspondent writes me from Liverpool in England, that he has paid for goods for me to the amount of £738 17 6 sterling; how much federal money must I pay him when I allow him 2$\frac{1}{2}$ per cent. commission?
Ans. dols. 3265,98$\frac{1}{12}$.

107. A merchant bought four chests of sugar, the mark and weight as follows, viz.

A, 10C. 3qrs. 14lb.
B, 12 1 17
C, 13 1 19
D, 11 2 10
} Gross; tare 38lb. each.

The prime cost including expenses, 18s. per cwt. and sold as follows, viz. the two first, A and B for 28s. per cwt. and the other two for 4d. per lb; I demand the prime cost, the whole gain, and the gain per cent.

Ans. Prime cost, £42 4 8$\frac{4}{7}$.
Whole gain, 34 14 11$\frac{13}{14}$.
Gain per cent, 82 5 1$\frac{467}{5915}$.

108. A jeweller bought a parcel of jewels for £120, and sold them again for £440, payable at the end of 6 months; I demand what the gain is worth in ready money, discounting 6 per cent. per annum, for present payment? Ans. £310 13 7 4

109. What is the value of 3 hogsheads of tobacco, weighing each gross 5C. 3qrs. 17lb. tare per hogshead 100lb. at dols. 19,50 per cwt? Ans. dols. $293\frac{26}{125}$.

110. If 10 hogsheads of sugar, weighing each 9C. 3qrs. 14lb. gross, tare per hogshead 100lb. cost 1093 dols.; how must I sell it per pound, to gain dols. 601,50? Ans. 15 cents.

111. What is $17\frac{1}{2}$ yards of cloth worth, at dols. 7,75 per yard? Ans. dols. $137,56\frac{25}{100}$.

112. Bought 2000 bushels of wheat, at 1 dol. per bushel; the store in which it was put bursted, and part of the wheat run out into the dock, and was spoiled, so as to be not worth saving; the remainder I sold at dol. 1,30 per bushel, and lost 830 dols. by the bargain; how much wheat was lost? Ans. 1100 bush.

113. Bought 2000 bushels of wheat, of which I lost 1100 bushels, sold the remainder for dol. 1,30 per bushel, and lost 830 dols; what did I give per bushel? Ans. 1 dol.

114. How many yards of stuff that is 3 quarters of a yard wide, will line a cloak, in which there are 4 yards of cloth that was 7 quarters wide? Ans. $5\frac{1}{3}$ yards.

115. What is the difference of latitude between Boston, in latitude of 42° 23′ North, and London, in Latitude of 51° 32′ North? Ans. 9° 09′.

116. What is the difference of longitude between Boston in longitude 71° 03′ West of Greenwich, and London, in 0° 05′ West of the same place?

Ans. 70° 58′

117. How many English statute miles is half the circumference of the earth, admitting the whole to be 360 degrees, and each degree $69\frac{1}{2}$ statute miles?

Ans. 12510 miles.

118. At 40 cents per yard, how much must be paid for painting the floor of a hall, which is 51 feet long, and 21 feet wide? Ans. dols. 47,60.

119. Paid dols. 47,60, being 40 cents per yard for painting the floor of a hall which is 51 feet long; how wide was it? Ans. 21 feet.

120. Paid dols. 47,60, for painting the floor of a hall, 51 feet long, and 21 feet wide; how much was it per yard? Ans. 40 cents.

121. Paid dols. 47,60, at 40 cents per yard for painting a floor which is 21 feet wide; required its length. Ans. 51 feet.

122. How much is $\frac{1}{2}$ of $\frac{2}{3}$, of $\frac{1}{4}$ of a dollar? Ans. 25 cents.

123. A military officer drew up his soldiers in rank and file, having the number in rank and in file equal; on being reinforced with three times his first number of men, he placed them all in the same form, and then the number in rank and in file was just double what it was at first; he was again reinforced with 12 times his first number of men; and after placing the whole in the same form as at first, his number in rank and in file was 40 men each; how many men had he at first, and after each reinforcement?

Ans. { 100 at first.
400 after the first reinforcement.
1600 after the second reinforcement.

124. At 2s. 3d. per square yard, I paid 12s. 9d. for painting a trough inside, which was 12 feet long, and 1 foot wide within; required its depth. Ans. 1 foot, 6 inches deep.

125. At 2s. 6d. per yard, a trough cost 10s. 5d. for painting inside, which was 1 foot wide, and 1 foot, 3 inches deep; required the length inside? Ans. 10 feet long.

126. What is the cube root of 46656? Ans. 36.

127. What is the square root of 1296? Ans. 36.

128. What proportion of 144 is 12? Ans. $\frac{1}{12}$.

129. How much is $\frac{1}{2}$ of $\frac{2}{3}$, of $\frac{3}{4}$ of 10 dols? Ans. dols. 2,50.

130. A merchant shipped for the West Indies, 150 thousand feet of boards, at 6 dols. per thousand, 2000 quintals of cod fish, at 3 dols. per quintal, 256 2qrs. 16lb. of candles, at 12½ cents per lb. 100 thousand shingles, at $2 per thousand; the charges of shipping

was 40 dols. the freight 2700 dols. for the whole. The whole together was sold for three times what it cost, (including all expenses.) In return he had 300 hogsheads of rum, for which he paid freight 3 dols. per hogshead, charges of shipping 15 dols. the whole, and received 2157 dols. in money; how much did the rum cost him per hogshead before shipping?

Ans. dols. 91,75.

131. A bartered with B, for 40 hogsheads of rum, containing in the whole 4320 gallons, at 50 cents per gallon, for which he gave B 54 chests of hyson tea, weighing each 70lb. gross; tare per chest 20lb; how much was A's tea valued at per lb? Ans. 80 cts.

132. Paid 2500 dols. for a note of £1000 currency of the State (in the United States) in which it was written; required the State, being the easternmost, that reckons by that currency. Ans. New York.

133. There is a stone of a cubic form, which in solid feet is 3,375; what is the length of each side?

Ans. 1,5 foot, or 1 foot, 6 inches.

134. There are seven points on a straight line, viz. A, B, C, D, E, F and G; the distance from A to B, is 10 yards; from A to C, is 30; from B to D, 50; from C to E, 70; from D to F, 90; from E to G, 110; required the distance from A to G, also the several distances from point to point on the whole line.

From { A, B, C, D, E, F, } to { B, C, D, E, F, G, } is { 10 20 30 40 50 60 } yds.

From A to { C, 30 D, 60 E, 100 F, 150 G, 210 } yds. Ans.

135. What number is that to which one fourth of itself being added, and from the sum, one tenth of itself be subtracted, 603 will remain? Ans. 536.

136. A gentleman has a number of farms, on each of which is 9 orchards, in each orchard 9 squares, in each square 9 apple trees; each tree produced 9 bushels of apples, with which he made 8748 barrels of cider, which took (on an average) 6 bushels, and 3 pecks of apples, per barrel; how many farms had he? Ans. 9 farms.

136. A and B bartered; A let B have 500 lb. of chocolate, and 25 dols. in money, for 100 gallons of rum; the chocolate was valued at 20 cents per lb. what was the rum per gallon? Ans. 65 cents.

137. How many hills of Indian corn can be planted on an acre of land, and in how many rows, allowing 4 feet width for each row, and 4 feet distance between the hills in the rows; the acre consisting of 43560 square feet, in a square form?

Ans. { 2722½ hills nearly. / 52,177575 rows nearly.

NOTE. *In the last example the number of hills is a very small fraction short of the answer above, and the number of rows a small fraction over.*

138. Three men have 1125 dols. to divide among them in such proportion, that as often as A has 4 dols. B is to have 6 dols. and as often as B has 9 dols. C is to have 12 dols; what is the share of each?

Ans. { A's / B's / C's } share is, { dols. 250. / 375. / 500.

139. Nineteen and ten, good honest men,
With sixteen more, and 40:
Spoke to a victualler to provide,
Meals for their little party;
He charg'd them ninety five cents each,
Because they ate quite hearty;
Pray how much money was the bill,
Paid by this little party?

Ans. dols. 80,75.

140. Shipped for the West Indies, 75 thousand feet of boards, which cost me dols. 7,50 per thousand.; 150 thousand of shingles, which cost dols. 2,50 per thousand; 1000 quintals of fish, which cost dols. 4,25 per quintal; had in return 80 hogsheads of rum, free of any expense for freight, or otherwise either way; sold the whole on board, for 75 cents per gallon, being 8640 gallons; what did I gain by this adventure?

Ans. dols. 2292,50.

SOME NECESSARY FORMS.

A BILL OF GOODS.

BOSTON, JAN. 30, 1810.

John Trader,

Bought of Henry Merchant,

5 pieces broadcloth, at $160	$800.	
12 pieces linen, at $18,75	225.	
9 do. cambric, at $8	72.	
	——	$1097.

Errors excepted.

H.—M.—

PROMISSORY NOTE.

PHILADELPHIA, FEB. 10, 1810.

For value received I promise to pay to A. B. or order, forty five dollars in thirty days.

ATTEST, G. H. C. D.

PROMISSORY NOTE FROM TWO.

BALTIMORE, JAN. 15, 1810.

For value received we jointly and severally promise to pay J. C. or order, four hundred dollars, and thirty five cents, in sixty days.

ATTEST, C. L. T. R.
G. K.

A BILL OF DEBT.

Mr. C. D. Dr. to A. B.

1810.		
Jan. 1,	For 3bbl. flour. at $6,25.	$18,75.
10,	„ 9lb. coffee, at 33 cts.	2,97.
15,	„ ¼ cwt. rice, at $6 per cwt.	1,50.
		$23,22

New York, Jan. 26, 1810.

Received payment. A. B.

X

Dr. *A. B. in account current with C. D.* *Cr.*

1810.		$	1810.		$
Jan. 1,	To 6 bushels of wheat, at $1,25,	7,50.	Jan. 17,	By cash,	9,50
10,	12 bushels of oats, at 50 cents,	6,	29,	5 bbl. cider, at $2,50	12,50.
18,	2 bbl. beef, at $10,	20,	31,	Cash for the balance,	36,50.
20,	1 do. pork,	25,			$58,50.
		$58,50.	Feb. 6, 1810.	Errors excepted.	C. D.

RECEIPT FOR MONEY RECEIVED ON ACCOUNT, OR IN PART OF A DEBT.

CHARLESTOWN, FEB. 15, 1810.

Received of John Trader, five hundred dollars, on account. H. M.

RECEIPT IN FULL.

CHARLESTOWN, FEB. 28, 1810.

Received of John Trader five hundred and ninety seven dollars, in full of all demands. H. M.

AN ORDER.

SAVANNAH, JAN. 10, 1810.

Sir,

Please to pay to Mr. A. C. or order, five hundred dollars, and charge to account of P. L.

Mr. R. Q.

THE END.

ERRATA.

P. 9, l. 6th from top, for *5* more, 3, are, read *5* more 3, are, &c.
43, Saturn's Longitude, for 6.25.19, read 7.25.19.
92, l. 23, fr. top, for *were* there were, read *where* there were.
93, lower line, for 2202, read 2187.
94, l. 2d from the top, for 2202, read 2187.
96, l. 7th from top, for 30 7 10, read 30 6 10.
,, l. 8th from top, for 15 7 10, read 15 6 10.
,, l. 5th from bottom for 6 0 1, read 6 4 3.
97, lower line, for 429 3 8, read 331 12 10.
102, l. 5th from bottom, for 114 8 9¼, read 187 2 9¼.
205, l. 20th from top, for 35 41 3, 15, read 35 41 3, 34.